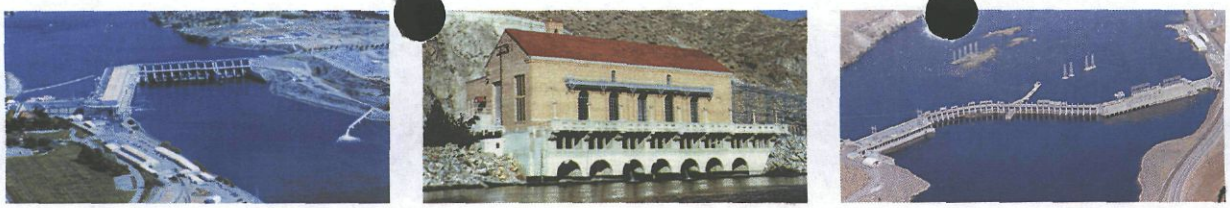

PUBLIC UTILITY DISTRICT NO. 1 *of* CHELAN COUNTY
P.O. Box 1231, Wenatchee, WA 98807-1231 • 327 N. Wenatchee Ave., Wenatchee, WA 98801
(509) 663-8121 • Toll free 1-888-663-8121 • www.chelanpud.org

September 10, 2007

Melissa Downes
Department of Ecology
15 West Yakima Ave -- Suite 200
Yakima, WA 98902-3452

Re: New Non-Consumptive Water Right for Chelan River Reach 4 Pump Station

Dear Ms. Downes:

On November 6, 2006, Chelan PUD received a new 50-year license for the Lake Chelan Hydroelectric Project (Project) that is based on the Settlement Agreement and Comprehensive Plan submitted to the Federal Energy Regulatory Commission (FERC or Commission) on October 17, 2003. The new license stipulates numerous requirements, including, but not limited to, habitat modifications and instream flows in Reach 4 of the Chelan River and in the Project's tailrace. To meet these requirements, Chelan PUD is requesting a new non-consumptive water right that will allow the diversion of up to 350 cfs from the project tailrace (Chelan River).

As stated above, the new application is to appropriate waters of the Chelan River. During our August 7 meeting with Department of Ecology staff, we confirmed that there is only one pending application associated with the Chelan River, which is associated with the proposed Chelan Falls Fish Rearing Facility (to be constructed and owned by Chelan PUD). This pending application is being reviewed and processed through the cost reimbursement process. Chelan PUD hereby requests that the new application for Reach 4 be processed simultaneously with the pending rearing facility application on a cost reimbursement basis.

Enclosed please find a Water Right Permit Application, a request for priority processing in Memo format with supporting documents, and a State Environmental Policy Act Checklist and Determination of Non-Significance. Additionally, please consider this letter our formal request to Ecology to initiate the cost reimbursement process.

We appreciate the time and attention Ecology has given this project and we look forward to continuing to work with you to see this project come to fruition.

Please feel free to contact me at 509-661-4627 if should have any questions, comments, or concerns.

Sincerely,

Waikele Hampton

Waikele Hampton
Environmental Permit Coordinator

DEPT OF ECOLOGY
Received
SEP 11 2007
CENTRAL REGION OFFICE

COMMISSIONERS: *Dennis S. Bolz, Ann Congdon, Norm Gutzwiler, Werner Janssen, Randy Smith* GENERAL MANAGER: *Richard Riazzi*

LOCATION MAP
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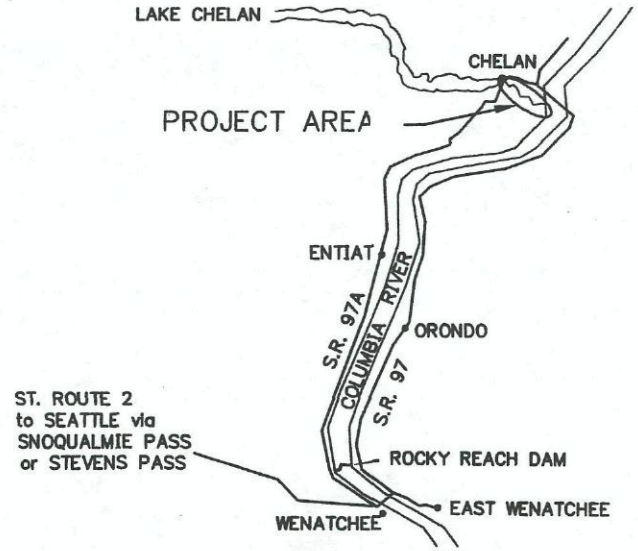

VICINITY MAP
SCALE=NTS

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REV	DATE	REVISION	REQ. BY	DRFT

PUBLIC UTILITY DISTRICT NO. 1 OF CHELAN COUNTY
WENATCHEE, WASHINGTON

Chelan Hydro

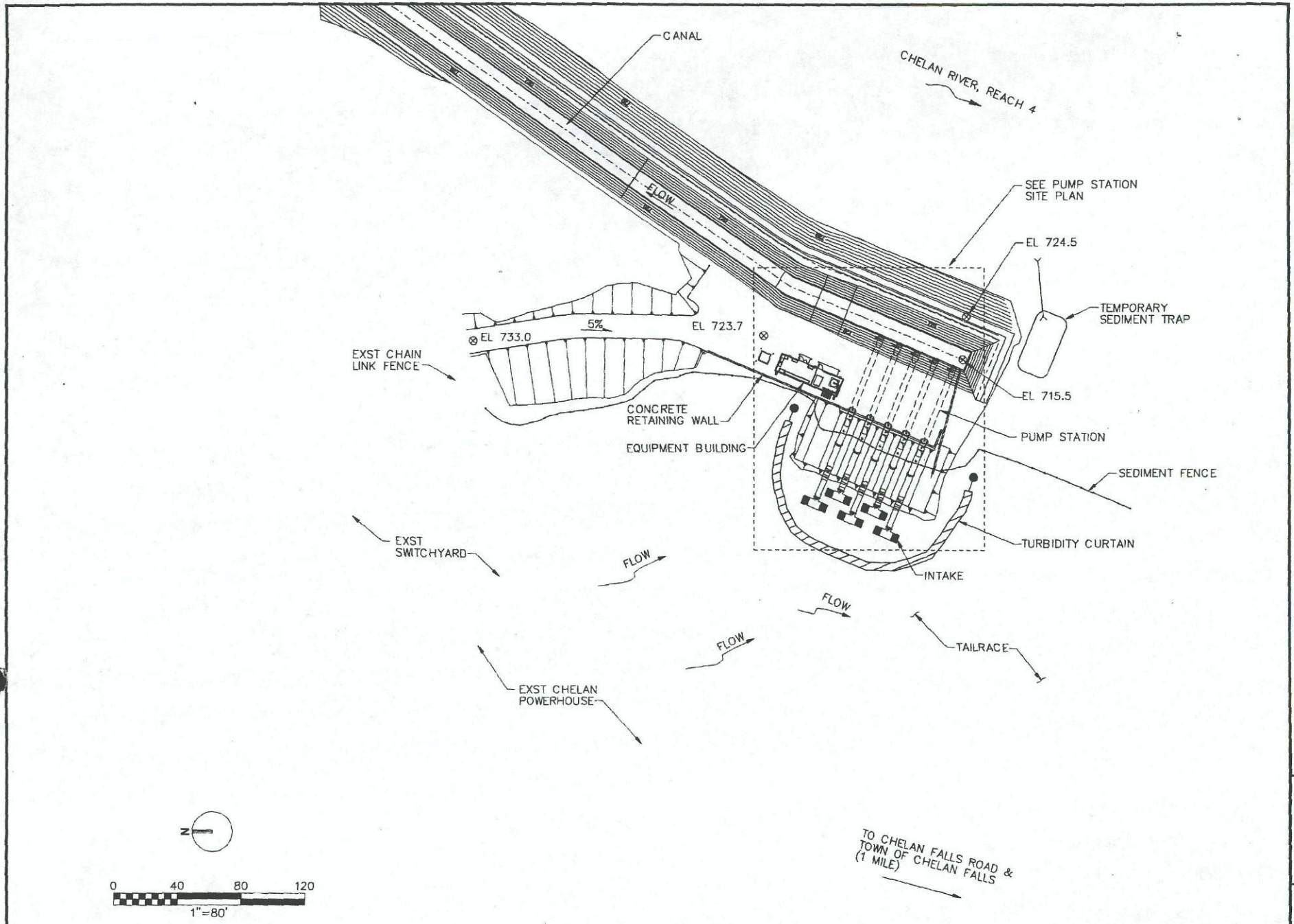
CHELAN TAILRACE PUMP STATION
LOCATION, VICINITY MAP

REVISION 0
DATE 5/23/2007
DWG. 0330-50GA-0019

ORIG. DRAWN MPS
ORIG. DATE 5/23/2007

DOCUMENT CLASS:
ID:
ORIGINAL DWG. #:


Figure 1: Project Detail
Minimum flow from low level outlet.
Powerhouse
Canal (1120 ft)
Pumps
Enhanced Reach 4 Channel (2220 ft)
Chelan River Channel
Tailrace (1380 ft)
Columbia River
Legend
Flow with powerhouse off
Flow with powerhouse on
Project Boundary
0 25 50 100 150 200
Feet
6/15/2007



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REV	DATE	REVISION	REQ. BY / DRFT

PUBLIC UTILITY DISTRICT NO. 1 OF CHELAN COUNTY
WENATCHEE, WASHINGTON
P.U.D.

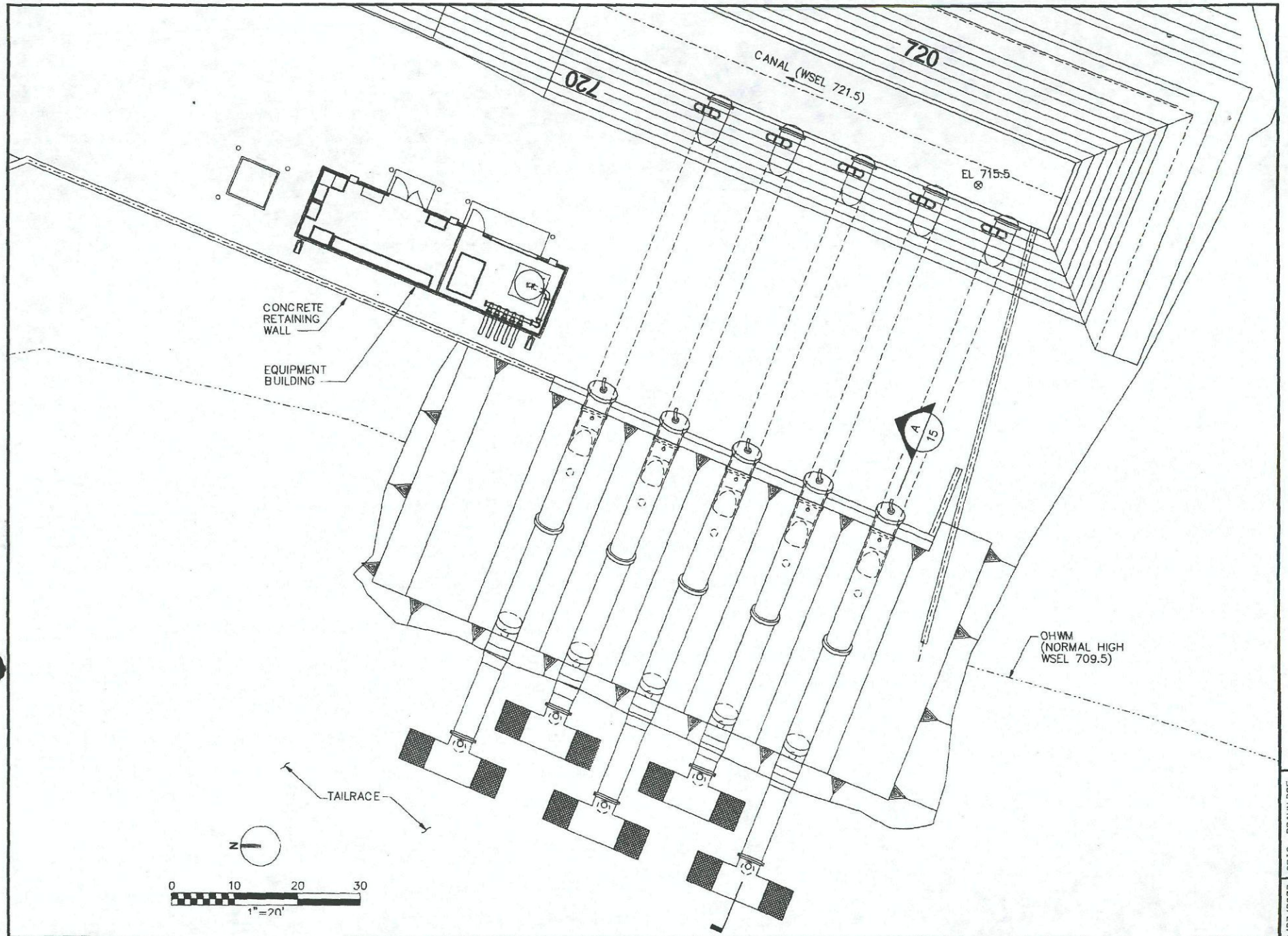
CHELAN HYDRO

CHELAN TAILRACE PUMP STATION
KEY MAP

REVISION 0
DATE 06/27/2007
DWG. 50CI-0020

ORIG. DATE 06/27/2007 | ORIG. DRAWN RSF

DOCUMENT CLASS: ID: ORIGINAL DWG. #:



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Ø	6/27/2007	PERMIT DRAWING	JGK	RSF
REV	DATE	REVISION	REQ. BY	DRFT

PUBLIC UTILITY DISTRICT NO. 1 OF CHELAN COUNTY
WENATCHEE, WASHINGTON
P.U.D.

CHELAN HYDRO

CHELAN TAILRACE PUMP STATION
PUMP STATION SITE PLAN

REVISION Ø
DATE 06/27/2007
DWG. 50C1-0021

ORIG. DATE 06/27/2007 ORIG. DRAWN RSF

DOCUMENT CLASS: ID: ORIGINAL DWG. *:

Chelan County PUD

Memo

To: Melissa Downes

From: Waikele Hampton

Date: September 7, 2007

Re: Reach 4 Pump Station Water Right Priority Processing

On November 6, 2006, Chelan PUD received a new 50-year license for the Lake Chelan Hydroelectric Project (Project) that is based on the Settlement Agreement and Comprehensive Plan submitted to the Federal Energy Regulatory Commission (FERC or Commission) on October 17, 2003. The new license stipulates numerous requirements, including, but not limited to, habitat modifications and instream flows in Reach 4 of the Chelan River and in the project's tailrace. The proposed water right is paramount in meeting these requirements.

Because Chelan PUD is on a rigorous schedule to complete the habitat and instream flow requirements set forth in the license, priority processing of the water right application is necessary. To be considered for priority processing for non-consumptive, environmentally beneficial water rights, as detailed in 173-152-050(2)(b), Ecology often requires letters of support from interested parties that attest to the environmental benefit of a proposed water use.

This Memorandum in support of priority processing first provides a brief background and an overview of the license documents that set forth the requirements related to the habitat modifications and instream flows in Reach 4 of the Chelan River and in the tailrace area. Attached to this Memorandum are the relevant sections of the license documents, as well as the signature pages associated with the Settlement Agreement. Based on conversations, meetings, and this Memorandum and supporting documents, it is our understanding that the Department of Ecology will process the application for a new, non-consumptive water right on a priority basis.

Background:

License Article 408 of the FERC License (issued November 6, 2006) and the associated License Article 7 of the Settlement Agreement and 401 Water Quality Certification (Dept. of Ecology Administrative Order No. 1233, dated June 1, 2004) for the Lake Chelan Hydroelectric Project mandates Chelan PUD implement specific measures to achieve the agreed upon objective of creating approximately two acres of useable spawning and rearing habitat for summer steelhead and Chinook salmon in Reach 4 of the Chelan River within two years of the effective date of the new License. Relevant sections of each of the above mentioned documents are attached.

The Settlement Agreement and Comprehensive Plan was signed by the U.S. Forest Service, the National Park Service, NOAA Fisheries, the U.S. Fish and Wildlife Service, the Washington State Department of Ecology, the Washington State Department of Fish and Wildlife, the Colville Confederated Tribes, the city of Chelan and the American Whitewater Affiliation (signature pages attached).

Requirements of the Project License:

License Article 408 of the FERC License

- Chelan PUD shall file for Commission approval, a Threatened and Endangered Species Protection Plan, which is to include, but not be limited to: (a) timely development of a system to release water at the Lake Chelan Dam or pump water from the project powerhouse tailrace to the Chelan River, and subsequent operation of that system at rates sufficient to continuously maintain flows equal to or greater than the flows required by the license for Chelan River Reach 4; (b) timely development of final designs and implementation of channel improvements in Chelan River Reach 4 and the powerhouse tailrace, and timely maintenance of anadromous fish habitat value of those improvements throughout the life of the license.

Lake Chelan Settlement Agreement, License Article 7 (b). Habitat Protection and Restoration Measures

- Minimum flows and ramping rates, as defined in section 2.6.5, Table 7-3, and section 3.2, table 7-6, respectively of Chapter 7 of the Comprehensive Plan.
- Habitat modification in Reach 4 and the tailrace, as set forth in section 3.1 and 3.2, respectively, of Chapter 7 of the Comprehensive Plan.
- Anadromous fish spawning flows in Reach 4, as set forth in section 3.3.6 of Chapter 7 of the Comprehensive Plan.
- Redd protection, as set forth in section 4.1.3, table 7-10, and section 4.1.3 of Chapter 7 of the Comprehensive Plan.

401 Water Quality Certification

- Minimum instream flows – The project shall provide and maintain the minimum instream flows for the Chelan River as described in the CRBEIP (Chelan River Biological Evaluation and Implementation Plan), Table 7-3.
- Habitat modifications and biological evaluation – Chelan PUD shall complete modifications to improve habitat in Reach 4 and the tailrace, as set forth in Section 3.1 and 3.2, respectively of the CRBEIP.

FERC Order

UNITED STATES OF AMERICA 117 FERC ¶62,129
FEDERAL ENERGY REGULATORY COMMISSION

Public Utility District No. 1 of Chelan County — Project No. 637-022

ORDER ON OFFER OF SETTLEMENT AND ISSUING NEW LICENSE

November 6, 2006

1. On March 28, 2002, Public Utility District No. 1 of Chelan County (Chelan PUD) filed an application for a new license pursuant to sections 4(e) and 15 of the Federal Power Act (FPA),[1] to continue operation and maintenance of the 48-megawatt (MW) Lake Chelan Hydroelectric Project No. 637 located on the Chelan River, near the City of Chelan, in Chelan County, Washington. The project occupies 465.5 acres of federal lands[2] administered by the U.S. Forest Service (Forest Service) and U.S. Department of the Interior, National Park Service (Park Service).[3]

2. On October 8, 2003, a settlement agreement (Agreement) was reached between Chelan PUD, Forest Service, Park Service, NOAA National Marine Fisheries Service (NMFS), United States Fish and Wildlife Service (FWS), Washington Department of Fish and Wildlife (Washington Fish and Wildlife), Washington Department of Ecology (Ecology), the Confederated Tribes of the Colville Reservation (Colville Tribes), American Whitewater, and the City of Chelan. On October 17, 2003, Chelan PUD, on behalf of the signatories, filed the comprehensive settlement agreement with the Commission requesting that the measures set forth in the proposed license articles in

[1] 16 U.S.C. §§ 797(e) and 808 (2000), respectively.

[2] The federal lands are in the Wenatchee National Forest and the Lake Chelan National Recreation Area of the North Cascades National Park. The Wenatchee Forest Reserve was established by Executive Order No. 825 on June 18, 1908. By Act of October 2, 1968, Pub. L. No. 90-554, Congress established the North Cascades National Park and designated the North Cascades National Recreation Area, the Lake Chelan National Recreation Area, and the Ross Lake National Recreation Area as components thereof.

[3] Because the project occupies lands of the United States, section 23(b)(10) of the FPA ,16 U.S.C. § 817(1) (2000), requires the project to be licensed.

reach of the Chelan River that is bypassed by the project.

10. Under the new license, Chelan PUD would have slightly greater flexibility in managing lake levels by establishing target elevations to be achieved between May 1 and October 1, rather than a fixed elevation by a date certain. Chelan PUD proposes to manage minimum lake elevations based on snow pack conditions, lake levels, predicted precipitation and runoff conditions, and operational objectives of maintaining minimum instream flows in the Chelan River, reducing high flows (greater than 6,000 cfs) in the Chelan River, providing usable lake levels for recreation (between 1,090 and 1,098), and ensuring the project can pass the probable maximum flood without dam failure, among other objectives. The previous license did not require a minimum flow release to the bypassed reach of the Chelan River. Chelan PUD proposes a minimum flow for the entire bypassed reach, supplemented with pumping of additional water from the tailrace into the lower portion of the Chelan River (Reach 4) to improve spawning habitat for listed salmon and steelhead. The proposed minimum flow varies depending on the time of year and whether it is a dry, normal, or wet water year.

11. Lake Chelan is a 32,560-acre reservoir at normal maximum water surface elevation of 1,100 feet msl, with a gross storage capacity of 15.8 million acre-feet and a useable storage of 677,400 acre-feet between elevations 1,079 and 1,100. Approximately 2,000 acres of land lie within the Lake Chelan Project boundary which follows the 1,100-foot contour line from the upper end of Lake Chelan near Stehekin, Washington, to the City of Chelan then continues down both sides of the 4.5-mile-long bypassed reach of the Chelan River to the confluence of the Chelan and Columbia rivers. About 1,300 acres of the project lands are inundated and project facilities occupy the other 700 acres. The project lands are owned by the Forest Service, Park Service, several state agencies, Chelan PUD, and private property owners. Approximately 465.5 acres are inundated federal lands.[9]

12. There are no primary transmission lines included in the Lake Chelan Project.[10] A project switchyard located 70 feet from the powerhouse connects the project power to Chelan PUD's interconnected transmission system.

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[9] These lands consist of 361.4 acres of Forest Service lands and 104.1 acres of National Park Service lands.

[10] Five 115-kilovolt (kV) transmission lines connect the project switchyard to the electrical system of the Chelan PUD, but none of these lines is part of the licensed project because project power is commingled with other power sources once it leaves the project substation.

web model for the lake; (b) fund the development and implementation of a fisheries monitoring and evaluation program; (c) remove alluvium barriers in 10 high priority tributaries to Lake Chelan to facilitate adfluvial salmonid access for spawning, and fund monitoring efforts to determine if the alluvial barriers reestablish; (d) fund Washington Fish and Wildlife efforts to rear and stock 5,000 pounds of salmonid fingerlings and 33,000 pounds of catchable-size salmonids in Lake Chelan; and (e) conduct 140 days of entrainment sampling over four sampling years in accordance with a sampling plan to be developed in consultation with Washington Fish and Wildlife, Forest Service, and Ecology. If 500 adult spawnable age/size westslope cutthroat trout are captured in the vicinity of the power tunnel entrance, the agencies and the licensee would evaluate the need to install fish protection or exclusion measures (Agreement Article 6).[16]

19. To restore fish and wildlife resources of the Chelan River, the licensee would implement the Chelan River Biological Evaluation and Implementation Plan (Agreement Article 7).[17] The plan consists of a number of measures to achieve reach-specific biological objectives that support, maintain, and protect designated uses and beneficial uses of the river. These measures include (a) time- and water-year-specific minimum flows and ramping rates (see section 2.6.5, table 7-3, and section 3.2, table 7-6, respectively of Chapter 7 of the Lake Chelan Comprehensive Plan); (b) habitat modifications in Reach 4 of the Chelan River and the project tailrace to improve steelhead and salmon spawning habitat; (c) pumping of additional tailrace water into Reach 4 as needed to improve spawning habitat conditions; (d) monitoring of salmon

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Colville Tribes, Yakama Nation, Ecology, Chelan PUD, and the Lake Chelan Sportsman's Association (*See* section 18.2.2 of the Settlement Agreement).

[16] If the licensee objects to the need for such protection measures, the Agreement provides that the licensee may conduct entrainment sampling within the power tunnel. If the licensee can not reach an agreement with the agency requesting the protection measures, it will refer the matter for dispute resolution pursuant to section 16 of the Agreement. If the licensee agrees to the protection or exclusion measures or the dispute resolution requires their installation, the licensee would consult with the Lake Chelan Fishery Forum to design the protection or exclusion devices, conduct tests necessary to determine their effectiveness, and upon successful design install the devices.

[17] Agreement Article 7 refers to the Chelan River Biological Evaluation and Implementation Plan as the Chelan River Fishery Plan; however, Chapter 7 of the Lake Chelan Comprehensive Plan and the 401 water quality certification refer to the plan as the Chelan River Biological Evaluation and Implementation Plan. They are the same plan.

and C, respectively, and made a part of this license by ordering paragraphs (D) and (E), respectively.

WATER QUALITY CERTIFICATION

31. Under section 401(a)(1) of the Clean Water Act (CWA),[27] the Commission may not issue a license for a hydroelectric project unless the state water quality certifying agency has issued water quality certification for the project or has waived certification by failing to act within a reasonable period of time, not to exceed one year. Section 401(d) of the CWA provides that state certification shall become a condition of any federal license that authorizes construction or operation of the project.[28]

32. On March 27, 2002, Chelan PUD applied to Ecology for water quality certification. On March 24, 2003, Ecology issued water quality certification for the Lake Chelan Project. The water quality certification was appealed by the Confederated Tribes of the Umatilla Reservation. The State Pollution Control Hearings Board upheld the water quality certification with nine specific clarifications, which are included in an amended and re-issued certification dated April 21, 2004.

33. The conditions of the certification consist of seven general requirements that require Chelan PUD: to comply with state water quality criteria and any future changes to those requirements; to implement the measures identified in the certification and the Chelan River Biological Evaluation and Implementation Plan; to prevent the discharge of any solid or liquid waste to water of the state without approval; to allow Ecology access as necessary to inspect the project operations and records required by the certification; to conduct additional monitoring or studies if necessary and required by Ecology to provide reasonable assurance of compliance with the water quality standards; and to keep copies of certification and other permits, licenses, and approvals on site and readily available to Chelan PUD staff, contractors, and Ecology.

34. The certification also includes specific conditions requiring instream flows and ramping rates in the Chelan River; habitat modifications in the river and project tailrace; adaptive management options to meet biological objectives; status reporting, consultation, and resolution of disagreement over new or modified measures to achieve biological objectives for the Chelan River; an implementation schedule; water quality monitoring, modeling and reporting requirements; requirements for conducting instream

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[27] 33 U.S.C. § 1341(a)(1) (2000).

[28] 33 U.S.C. § 1341(d) (2000).

the completed plan after it has been prepared and provided to the entities above, and specific descriptions of how the entities' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the entities to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensees' reasons, based on project-specific reasons.

The Commission reserves the right to require changes to the plan. Upon Commission approval the licensee shall implement the plan, including any changes required by the Commission.

Article 408. *Threatened and Endangered Species Protection Plan.* Within six months of the issuance date of the license, the licensee shall file for Commission approval, a Threatened and Endangered Species Protection Plan. The plan shall include, but not be limited to, provisions for the following: (a) timely development of a system to release water at the Lake Chelan Dam or pump water from the project powerhouse tailrace to the Chelan River, and subsequent operation of that system at rates sufficient to continuously maintain flows equal to or greater than the flows required by this license for Chelan River Reach 4; (b) timely development of final designs and implementation of channel improvements in Chelan River Reach 4 and the powerhouse tailrace, and timely maintenance of anadromous fish habitat value of those improvements throughout the life of the license; (c) timely determination of the need to take actions to improve water quality characteristics adversely affecting anadromous fish, and identification and implementation of appropriate actions; (d) timely annual payments to the tributary streamflow enhancement program pursuant to Article 14 of the Lake Chelan Settlement Agreement (included in Appendix A to this license); (e) ensuring that any construction activities in or near waterways at the project comply with the construction practices described in Appendix E to this order; (f) monitoring of flows in the project tailrace and in Reach 4 of the Chelan River, electronic posting (e.g., on a website) of information, and annual reporting of monitoring results; and (g) filing of an annual implementation and monitoring report with the National Marine Fisheries Service (NMFS) and the Commission by January 31 of each year to document all measures completed in the previous year in accordance with Article 14 of the Lake Chelan Settlement Agreement.

The plan shall be prepared after consultation with NMFS. The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations prior to filing the plan with the Commission for approval.

If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval the licensee shall implement the plan, including any changes required by the Commission.

Article 409. *Reservation of Authority—Fishways.* Authority is reserved to the Commission to require the licensee to construct, operate, and maintain, or to provide for the construction, operation, and maintenance of such fishways as may be prescribed by the Secretary of the Interior or the Secretary of Commerce pursuant to section 18 of the Federal Power.

Article 410. *Programmatic Agreement and Historic Properties Management Plan.* The licensee shall implement the "Programmatic Agreement Among the Federal Energy Regulatory Commission, the Washington State Historic Preservation Officer, and the Confederated Tribes of the Colville Reservation Tribal Historic Preservation Officer for Managing Historic Properties that May be Affected by a License Issuing to Public Utility District No. 1 of Chelan County for the Continued Operation of the Lake Chelan Hydroelectric Project in Chelan County, Washington (FERC No. 637-022)" executed on September 28, 2005, and including but not limited to the Lake Chelan Historic Properties and Cultural Management Plan (HPCMP) for the project filed on October 8, 2003. The HPCMP is approved. The Commission reserves the authority to require changes to the HPCMP at any time during the term of the license.

Article 411. C*olumbia River Basin Fish and Wildlife Program.* The Commission reserves the authority to order, upon its own motion or upon the recommendation of federal and state fish and wildlife agencies, affected Indian Tribes, and the Northwest Power and Conservation Council, alterations of project structures and operations to take into account to the fullest extent practicable the regional fish and wildlife program developed and amended pursuant to the Pacific Northwest Electric Power Planning and Conservation Act.

Article 412. *Use and Occupancy.* (a) In accordance with the provisions of this article, the licensee shall have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain types of use and occupancy, without prior Commission approval. The licensee may exercise the authority only if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. For those purposes, the licensee shall also

Article 7

LAKE CHELAN LICENSE ARTICLES

Attachment A to the Lake Chelan Settlement Agreement

LAKE CHELAN HYDROELECTRIC PROJECT
FERC Project No. 637

October 8, 2003

P.U.D.
CHELAN COUNTY
POWER

Public Utility District No. 1 of Chelan County
Wenatchee, Washington

Article 7. Chelan River Fishery Plan

Within one year of the effective date of the New License, Chelan PUD shall begin implementation of the plan to restore the fish and wildlife resources of the Chelan River, as described in this License Article and Chapter 7 of the Comprehensive Plan, which is incorporated herein by reference.

(a) **Biological objectives.** The Chelan River restoration plan is designed to achieve certain biological objectives concerning restoration and/or enhancement of biological resources in four separate reaches of the river and to support, maintain, and protect the designated and existing beneficial uses of the Chelan River basin, pursuant to applicable federal and State law. The biological objectives that Chelan PUD shall attempt to achieve for each reach are set forth in detail in section 4 of Chapter 7 of the Comprehensive Plan. The Parties believe that achievement of these biological objectives, through implementation of this License Article, would substantially restore a significant number of environmental values associated with the Chelan River.

(b) **Habitat Protection and Restoration measures.** Chelan PUD shall implement the following habitat protection and restoration measures:

(1) **Minimum flows and ramping rates**. Chelan PUD shall comply with the minimum flows and ramping rates provisions set forth in section 2.6.5, table 7-3, and section 3.2, table 7-6, respectively, of Chapter 7 of the Comprehensive Plan as soon as the structures needed to provide such flows are constructed, which shall occur no later than two years after the effective date of the New License. The structures for which construction is needed are a new flow release structure at the dam, estimated to cost $350,000, and modifications to the channel in Reach 4. Prior to the date such structures are completed, Chelan PUD shall provide flows consistent with Chapter 7 of the Comprehensive Plan for the purposes of testing designs or structures or gathering other data, including water quality data.

(2) **Habitat modification in Reach 4 and the tailrace.** Not later than two years after the effective date of the New License, Chelan PUD shall complete modifications to improve habitat in Reach 4 and the tailrace, as set forth in section 3.1 and 3.2, respectively, of Chapter 7 of the Comprehensive Plan. Chelan PUD shall use standard river habitat restoration techniques to provide and maintain gravel areas for spawning, create pools, increase channel sinuosity, and moderate velocities, as described in sections 3.1, figure 7-9, and section 3.2, figure 7-10, in Chapter 7 of the Comprehensive Plan, or as agreed to by the Chelan River Fishery Forum (CRFF). This habitat work is estimated to have a capital cost of $500,000.

(3) **Anadromous Fish Spawning Flows in Reach 4.** Beginning 90 days after the habitat modification in subsection (2) of this Article has been completed, Chelan PUD shall comply with the provisions for the pumping of tailrace water into Reach 4 set forth in section 3.3.6 of Chapter 7 of the Comprehensive Plan. As described in section 3.3.6, these additional flows into Reach 4 during the steelhead and late-run chinook spawning periods are to provide greater depths and velocities, which will improve spawning habitat conditions for these species. The capital cost for the pumping station is estimated to be $2,500,000, with annual operating costs of $20,000.

(4) **Redd Protection.** Upon the effective date of the New License, Chelan PUD shall comply with the redd protection provisions set forth in section 4.1.3, table 7-10, and section 4.1.3 of Chapter 7 of the Comprehensive Plan. This measure is for the purpose of preventing damage to salmon redds that might occur as a result of powerhouse shutdown. As described in Chapter 7 of the Comprehensive Plan, detection of low dissolved oxygen (DO) levels in redds in the tailrace could trigger implementation of several alternatives, including intermittent powerhouse operation or installation and use of flow release pipes buried in the gravel.

(c) **Implementation Program.** Chelan PUD shall undertake the following program to monitor, evaluate, and adapt, where needed, the protection and restoration measures:

(1) **Monitoring and evaluation.** Chelan PUD shall begin implementation of all monitoring, evaluation, and reporting requirements set forth in section 5.4 and figure 7-13 of Chapter 7 of the Comprehensive Plan as soon after the effective date of the New License as practically feasible, but no later than two and one-half years after the effective date of the New License. The monitoring and evaluation program shall provide the basis for determining whether the biological objectives have been met. The monitoring and evaluation program shall also provide information needed to make changes to the habitat protection and restoration or monitoring and evaluation measures as may be appropriate to facilitate achievement of the biological objectives and of effective monitoring and evaluation. The monitoring and evaluation program will be used to determine if measures beyond those defined in subsection (b) of this License Article should be implemented.

(2) **Reporting and evaluation of success and recommendation of new or modified measures.** By no later than April 30, in each of years 4, 6, 8, and 10 following the effective date of the New License, Chelan PUD shall provide to the CRFF a final Biological Objectives Status Report that (1) summarizes the results of the monitoring and evaluation program, and evaluates the need for modification of the program, (2) describes the degree to which the biological objectives have been achieved, and the prospects for achieving those objectives in the next reporting period, (3) reviews measures implemented to meet those biological objectives, and (4) recommends any new or modified measures, including monitoring and evaluation, needed to achieve the biological objectives, to the extent practicable (hereinafter referred to as "new or modified measures"). Such recommendations shall contain a schedule for implementation. No later than February 28 of each such year, Chelan PUD shall provide a draft of such final report to the CRFF and consult with its members prior to issuing the final report. If a CRFF member is not in agreement with the draft report or recommendations and has an alternative evaluation or recommendation, Chelan PUD shall include a discussion of that alternative evaluation or recommendation in the final report.

(3) **Management options to achieve compliance with biological objectives.** Section 3.6 of Chapter 7 of the Comprehensive Plan sets forth a number of additional management options that Chelan PUD may implement to address specific problems that may arise in achieving biological objectives. Such options include pumping of tailrace water into Reach 4 for rearing salmonids, and actions to reduce the temperature in Reaches 1-3 (site-potential shade, refugia enhancement, flow increases during hot weather or daytime). These options have been identified as potential

actions regarding the problems in question; however, future recommendations are not limited to these options.

(4) **Implementation if agreement reached on new or modified measures.** If Consensus is achieved by the CRFF and Chelan PUD as to new or modified measures needed to achieve the biological objectives or to carry out monitoring and evaluation, the recommended measures shall be become part of the plan and implemented in accordance with an agreed schedule or, absent an agreed schedule, by August 1 of the reporting year. These new and modified measures are deemed to be part of the New License if Consensus is achieved by the CRFF and Chelan PUD. If, however, such measures require an amendment to the New License or FERC approval, Chelan PUD shall petition FERC to so amend the New License.

(d) **Dispute Resolution and Reservation of Authority**

(1) **Resolution of disagreements over new or modified measures.** If, within 60 days after issuance of the final Biological Objectives Status Report, the CRFF and Chelan PUD do not reach consensus as to new or modified measures needed to achieve the biological objectives, to the extent practicable, including the implementation schedule, or to carry out monitoring and evaluation, such disagreement shall be subject to dispute resolution pursuant to section 16 of this Agreement. During the pendancy of the dispute resolution process, the minimum level of new or modified measures that the CRFF and Chelan PUD can agree upon shall be implemented.

(2) **Compliance with biological objectives and state water quality standards.** Chelan PUD shall comply with the implementation schedule as provided in Tables 7-10 and 7-11 in Chapter 7 of the Comprehensive Plan. No later than 10 years after the effective date of the New License, Chelan PUD shall provide WDOE with the information necessary to make a determination as to whether the biological objectives in Chapter 7 of the Comprehensive Plan and state water quality standards have been achieved. WDOE agrees that it shall confer with the CRFF prior to making a determination whether and to what extent the biological objectives contained in Chapter 7 have been met. If an Agency with relevant authority or Chelan PUD disagrees with WDOE's determination, it may invoke the dispute resolution process pursuant to section 16 of this Agreement. If WDOE determines that the biological objectives have been met but non-compliance with water quality standards exists, WDOE intends to initiate a process, if necessary, to modify the applicable standards through rulemaking or such alternative process as may otherwise be authorized under applicable federal and state law. If WDOE determines that some or all of the biological objectives have not been met and that Chelan PUD has undertaken all known, reasonable, and feasible measures to achieve those objectives consistent with supporting, protecting, and maintaining the designated and existing beneficial uses, WDOE intends to initiate a process to modify the applicable water quality standards to the extent necessary to eliminate any non-compliance with such standards. Such modification of state standards shall not release Chelan PUD from compliance with the implementation and monitoring measures required by this Article or Chapter 7 of the Comprehensive Plan. Chelan PUD shall, upon request by WDOE, fully respond to all reasonable requests for materials to assist WDOE in making determinations under this section and in any resulting rulemaking or other process.

(3) **Actions if Biological Objectives Not Achieved.** Following the issuance of the final Biological Objectives Status Report in year 10, if Chelan PUD concludes that one or more biological objectives cannot be met in whole or in part despite its having undertaken all known, reasonable, and feasible measures to meet those objectives consistent with supporting, protecting, and maintaining the designated and existing beneficial uses, Chelan PUD may consult with the CRFF regarding whether to modify or eliminate a biological objective and/or associated implementation measure. Any disagreement resulting from such consultation shall be subject to dispute resolution pursuant to section 16 of the Agreement. Any changes to such biological objectives or implementation measures require the written consent of the WDOE, which shall not be unreasonably withheld pursuant to applicable federal and state law.

(4) **WDOE reservation of authority.** WDOE reserves the authority to issue orders to require new or modified measures beyond those otherwise provided for in this License Article and Chapter 7 of the Comprehensive Plan as may be reasonable and necessary to meet applicable water quality standards and other appropriate requirements of state law. In exercising such authority, WDOE shall consider any conflicts that arise between designated and/or existing beneficial uses, and reconcile such conflicts in a reasonable manner consistent with applicable state and federal law. Such new or modified measures may include, but are not limited to, changes to minimum flows and ramping rates. Prior to exercising such authority, WDOE agrees to issue a notice of intent to exercise its authority under this section. An Agency with relevant authority or Chelan PUD may within thirty days of such issuance initiate dispute resolution pursuant to section 16 of the Agreement. However, WDOE's authority shall not be limited by the outcome of the dispute resolution process contained in section 16 of the Agreement. Further, prior to exercising any such authority, WDOE will seek public input; however, if WDOE determines that, under the circumstances, more expeditious action is required, WDOE may limit such opportunities. This reservation of authority is not intended to create a right for Chelan PUD to seek review before the FERC of WDOE's exercise of such authority beyond that which may exist under applicable laws. Further, this provision is not intended to limit WDOE's authority to address unlawful discharges or other unlawful acts involving the Project that are actionable under RCW 90.48.

(5) **Chelan PUD withdrawal and reservation of right to contest.** In the event that WDOE imposes, under section (d)(4) of this Article, new or modified measures that cause the estimated capital costs required in sections (b)(2) and (b)(3) to increase by more than 25 percent, or the flow volumes required in section (b)(1) to increase by more than 2,900 cfs-days (i.e., 10 percent of the 80 cfs minimum flow), Chelan PUD may withdraw from the Agreement, which shall then be null and void. The costs associated with sections (c)(1) and (c)(2) of this Article shall not be considered a cost increase for the purposes of this section. The flow volume associated with Table 7-3 in section 2.6.5 and in section 3.3.7 (5,000 cfs-days) of Chapter 7 of the Comprehensive Plan shall not be considered an increase in volume for the purposes of this section. Prior to withdrawing, Chelan PUD shall engage in dispute resolution pursuant to section 16 of the Agreement. Chelan PUD reserves the right to contest the requirement of new or modified measures by WDOE on any and all legal grounds.

In the event that measures required to provide for redd protection would exceed the capital cost or flow limitations of this subsection, Chelan PUD may also either exceed such

limitations, remove the spawning habitat in the tailrace, or exclude fish from the tailrace. Removal of the spawning habitat or exclusion of fish from the tailrace shall occur only upon approval by the Agencies with relevant authority.

Article 8. Lake Level Plan

(a) Beginning within one year of the effective date of the New License, and for the term of the New License, including any subsequent annual licenses, Chelan PUD shall make every reasonable effort to comply with the Lake level management practices described in Chapter 8 of the Comprehensive Plan, which is incorporated herein by reference. Specifically, Chelan PUD shall make every reasonable effort to comply with the following objectives (contained in section 3.1 of Chapter 8 of the comprehensive Plan): (1) maintaining minimum flows in the Chelan River (this objective has priority over lake levels); (2) reducing high flows in the Chelan River (this objective has priority over lake levels); (3) satisfying regulatory requirements for flood control (adjusting lake level); (4) providing usable lake levels for recreation (which varies between elevation 1,090 and 1,098 ft., depending on the slope of the shoreline and boat dock configurations); (5) reduce shoreline erosion; (6) preventing fish passage blockages (due to tributary barriers); and (7) minimizing the effect of refill on attainment of flow objectives for salmon in the mainstem Columbia River.

(b) Table 8-1 in Chapter 8 of the Comprehensive Plan, and included below, indicates the lake level elevations that Chelan PUD shall seek to achieve, to the extent consistent with the objectives listed in subsection (a) of this Article:

Proposed Lake Elevations (PME14)

Day	Minimum Elevation (ft)
May 1	1,087.6
June 1	1,094.0
July 1	1,098.0
August 1	1,099.0
September 7	1,098.7
October 1	1,097.2

Article 9. Wildlife Habitat Plan

Chelan PUD shall implement its responsibilities under the Wildlife Habitat Plan, as described in Chapter 9 of the Comprehensive Plan, which is incorporated herein by reference. Specifically:

(a) **Wildlife Habitat Restoration.** (1) Within 180 days of the effective date of the New License, Chelan PUD shall make available $220,000 to the Chelan-Douglas Land Trust, for the acquisition of conservation easements in perpetuity on privately-owned lands located on the north shore of Lake Chelan, in accordance with section 4.1.1 of the Comprehensive Plan. For

Signature Pages

LAKE CHELAN SETTLEMENT AGREEMENT

Final

LAKE CHELAN HYDROELECTRIC PROJECT
FERC Project No. 637

October 8, 2003

P.U.D.
CHELAN COUNTY
POWER

Public Utility District No. 1 of Chelan County
Wenatchee, Washington

For Chelan PUD:
Director of Licensing
327 N Wenatchee Avenue
Wenatchee, WA 98801

For USDA Forest Service:
District Ranger
Okanogan-Wenatchee National Forest
428 W Woodin Avenue
Chelan, WA 98816

For National Park Service:
Superintendent
North Cascades National Park Service Complex
810 State Route 20
Sedro-Woolley, WA 98284

For NOAA Fisheries:
Hydrologist
National Marine Fisheries Service
525 NE Oregon Street, Suite 5000
Portland, OR 97232-2737

For United States Fish and Wildlife Service:
Project Leader
215 Melody Lane, Suite 119
Wenatchee, WA 98801

For Washington State Department of Ecology:
Central Region Section Manager
Water Quality Program
Central Region Office
15 W Yakima Avenue, Suite 200
Yakima, WA 98902

For Washington State Department of Fish and Wildlife:
Eastern Mitigation Coordinator
3860 Chelan Highway
Wenatchee, WA 98801

For Confederated Tribes of the Colville Reservation:
Post Office Box 150
Nespelem, WA 99155

For City of Chelan:
City Administrator
135 E Johnson
Chelan, WA 98816

For American Whitewater Affiliation:
Conservation Director
482 Electric Avenue
Bigfork, MT 59911

Section 22. Signatures

22.1. **Signatory Authority.** Each signatory to this Agreement certifies that he or she is authorized to execute this Agreement and to legally bind the Party he or she represents, and that such Party shall be fully bound by the terms hereof upon such signature without any further act, approval, or authorization by such Party.

22.2. **Signing in Counterparts.** This Agreement may be executed in any number of counterparts, and each executed counterpart shall have the same force and effect as an original instrument as if all the signatory Parties to all of the counterparts had signed the same instrument. Any signature page of this Agreement may be detached from any counterpart of this Agreement without impairing the legal effect of any signatures, and may be attached to another counterpart of this Agreement identical in form having attached to it one or more signature pages.

Dated this 8th day of October, 2003.

For Chelan PUD:

Charles J. Hosken

Charles J. Hosken, General Manager

For the USDA Forest Service:

Lisa E Friedman

for Linda Goodman
Regional Forester, Pacific Northwest Region

10/9/03

For the National Park Service:

William F. Paleck, Superintendent
North Cascades National Park Service Complex

For the NOAA Fisheries:

Brian J. Brown

D. Robert Lohn, Regional Administrator

For the United States Fish and Wildlife Service:

Mark D. Miller

Mark Miller, Project Leader
Central Washington Field Office

For the Washington Department of Ecology:

Polly Zehm

Polly Zehm, Central Region Director

For the Washington Department of Fish and Wildlife:

Jeff P. Koenings, Ph.D., Director

For the Confederated Tribes of the Colville Reservation:

Joseph A. Pakootas Chairman
(Signature, Title)

For the City of Chelan:

W. Mitchell Atkinson

Mitch Atkinson, Mayor

For American Whitewater Affiliation:

John Gangemi, Conservation Director

401

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
15 West Yakima Avenue, Suite 200 • Yakima, Washington 98902-3452 • (509) 575-2490

June 1, 2004

CERTIFIED MAIL
7003 2260 0002 9878 0325

Gregg Carrington
Relicensing Project Manager
Public Utility District No. 1 of Chelan County
PO Box 1231
Wenatchee, WA 98807-1231

RE: Lake Chelan Hydroelectric Project (FERC No. 637)
401 Certification - Order No. 1233

Dear Mr. Carrington:

Enclosed is Ecology Administrative Order No. 1233. The purpose of this Order is to amend the 401 certification per Pollution Control Hearings Board (PCHB) Order No. 03-075, dated April 21, 2004, to include the clarifications that the Board directed be added. The 30-day appeal period for the PCHB order ran as of May 21, 2004, so the Board's order is now final. This Ecology order amends the previous Ecology Order No. DE 03WQCR-5420.

This certification is subject to the conditions contained in the enclosed Order. If you have any questions, please contact Pat Irle at (509) 454-7864. Written comments and correspondence relating to this document should be directed to Section Manager, Water Quality Program, Department of Ecology, Central Regional Office, 15 W. Yakima Avenue, Suite 200, Yakima, WA 98902.

Because this order merely transmits without change the clarifications required by the PCHB, no new appeal period is triggered.

Sincerely,

G. Thomas Tebb, L.E.G.
Section Manager
Water Quality Program
GTT:wv

Enclosure

cc: Secretary, FERC
Rod Woodin, WDFW
Steve Lewis, USFWS
Rich Domingue, NOAA Fisheries
Alan Quan, USDA-FS
Bill Paleck, NPS
Brett Swift, American Rivers
Bob Heinith, CRITFC
Carl Merkle, Umatilla Tribe
John Gangemi, American Whitewater
Bob Rose, Yakama Nation

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

IN THE MATTER OF GRANTING A WATER QUALITY CERTIFICATION TO: Lake Chelan Hydroelectric Project in accordance with 33 U.S.C. 1341 FWPCA § 401, RCW 90.48.260 and Chapter 173-201A WAC	))))))	ORDER NO. 1233 (Amended Order No. DE 03WQCR-5420) Licensing of the Lake Chelan Hydroelectric Project (FERC #637) Chelan County, Washington

TO: Mr. Gregg Carrington
Relicensing Project Manager
Public Utility District No. 1 of Chelan County
P.O. Box 1231
Wenatchee, WA 98807-1231

On March 27, 2002, the Public Utility District No. 1 of Chelan County (Chelan PUD) filed an application with the State of Washington Department of Ecology (Ecology) requesting issuance of a certification under the provisions of 33 USC 1341 (FWPCA § 401) for their application for a license to the Federal Energy Regulatory Commission for the Lake Chelan Hydroelectric Project certifying that the project will comply with applicable provisions of 33 USC 1311, 1312, 1313, 1316, 1317 and with any other appropriate requirement of state law. Ecology subsequently issued a 401 certification for the project; that certification was amended and re-issued on April 21, 2003. The certification was appealed to the state Pollution Control Hearings Board. The Board issued Order No. 03-075 on April 21, 2004, upholding the 401 certification, with nine (9) specific clarifications. This amended 401 certification and amended Order consist of the appealed 401 certification with the nine clarifications included as Section X of the 401 Certification.

NATURE OF PROJECT:

The Chelan Dam Hydroelectric Project generates 48 megawatts of hydropower. The project includes a diversion dam at the head of the Chelan River, at the southeast end of Lake Chelan, near the city of Chelan. The diversion dam is 40 feet high and 490 feet long. The dam controls the elevation of Lake Chelan, a 55-mile long natural lake. The dam also controls the flow to the Chelan River, which is 4.1 miles long and empties into the Columbia River. Water for hydropower is conveyed from the intake at the dam to the powerhouse through a 14-foot diameter, 2.2-mile-long power tunnel which transitions to 12 feet in diameter prior to bifurcating to form two penstocks, 90 feet in length. The penstock empties into a tailrace, about 1,700 feet from the Columbia River, just south of the mouth of the Chelan River.

AUTHORITIES:

In exercising authority under 33 U.S.C. 1341 and RCW 90.48.260, Ecology has investigated this application pursuant to the following:

1. Conformance with all applicable water quality-based, technology-based, and toxic or pretreatment effluent limitations as provided under 33 U.S.C. Sections 1311, 1312, 1313, 1316, and 1317 (FWPCA Sections 301, 302, 303, 306, and 307);

2. Conformance with the state water quality standards as provided for in Chapter 173-201A WAC authorized by 33 U.S.C. 1313 and by Chapter 90.48 RCW, and with other appropriate requirements of state law; and,

3. Conformance with any and all applicable provisions of Chapter 90.48 RCW and of using all known, available and reasonable methods to prevent and control pollution of state waters as required by RCW 90.48.010.

CERTIFICATION:

In view of the foregoing and in accordance with 33 USC 1341, RCW 90.48.260 and Chapter 173-201A WAC, it is ordered that:

1. Subject to the attached conditions, certification under the provisions of 33 USC 1341 is granted to Chelan PUD for the Lake Chelan Hydroelectric Project.
2. This certification does not exempt compliance with the state's Shorelines Management Act.
3. This certification does not exempt compliance with other statutes and codes administered by federal, state and local agencies.
4. This certification will cease to be valid if the project is constructed and operated in a manner not consistent with the application for certification, or the attached conditions of the certification.
5. This certification will cease to be valid and the applicant must reapply with an updated application if five or more years elapse between the date of the issuance of this certification and receipt of federal license.
6. This certification will cease to be valid and the applicant must reapply with an updated application if the information contained in the application is voided by subsequent submittals to the federal agency.
7. The conditions of this certification may be modified by Ecology or the certification will cease to be valid, as determined by Ecology, if there is a change in the terms of the Settlement Agreement, or of any of its components, particularly the Comprehensive Plan, Chapter 7, "Chelan River Biological Evaluation and Implementation Plan" (CRBEIP) (revised April 18, 2003 and included as an attachment), after this 401 certification has been issued. Ecology also reserves authority to modify this certification pursuant to the attached conditions.

Any person who fails to comply with any provision of this Order shall be liable for a penalty of up to ten thousand dollars for each day of continuing noncompliance.

This Order may not be appealed.

June 1, 2004 at Yakima, Washington

G. Thomas Tebb, L.E.G.
Water Quality Section Manager
Central Regional Office
Department of Ecology
State of Washington

Attachment: Chelan River Biological Evaluation and Implementation Plan (CRBEIP)

ORDER NO. 1233

401 CERTIFICATION CONDITIONS FOR THE LAKE CHELAN HYDROELECTRIC PROJECT
(FERC No. 637)

I. General Requirements

A. All water quality criteria as specified in Chapter 173-201A WAC apply to the various waters affected by this project and the Chelan PUD shall comply with those criteria. Nothing in this order shall be construed to allow the Chelan PUD to violate Washington's water quality standards, with the sole exception of such non-compliance associated with the ten year compliance schedule set forth herein.

B. The Chelan PUD shall implement the measures identified herein and in the Chelan River Biological Evaluation and Implementation Plan (CRBEIP revised April 18, 2003)[1] under the schedule agreed to within the Settlement Agreement. The Settlement Agreement provides for ten years or less to achieve the biological objectives.

C. In the event of changes or amendments to the state water quality standards (Chapter 173-201A WAC), or changes in or amendments to the state Water Pollution Control Act (RCW 90.48), or changes in or amendments to the Federal Clean Water Act, such provisions, standards, criteria or requirements shall also apply to this project and any attendant agreements, orders or permits.

D. Discharge of any solid or liquid waste to the waters of the state of Washington without approval from Ecology is prohibited.

E. The PUD shall allow Ecology such access as necessary to inspect the project operations, project area and project records required by this certification in order to monitor compliance with the conditions of this order.

F. Ecology retains the right to require additional monitoring or studies if necessary to provide reasonable assurance of compliance with water quality standards.

G. Copies of this order and associated permits, licenses, approvals and other documents shall be kept on site and made readily available for reference by PUD staff, its contractors and consultants, and by Ecology.

II. Findings

A. Historically, the Chelan dam has diverted water from most of the 4.1 miles of the Chelan River. This has left the river dry much of the year and hence in some areas eliminated and in others severely limited fish use of the river.

B. Historically, prior to the project, during most of the summer, temperatures in the Chelan River would have exceeded 18.0° C, which is the target under current Class A standards. Ecology Standards do not allow a human activity to increase a water temperature by greater than 0.3° C when water is above 18.0° C. Studies performed

[1] Chelan River Biological Evaluation and Implementation Plan, Chelan PUD No. 1, (revised April 18, 2003.)

for this project predict that the proposed minimum flows for the Chelan River would result at times in temperature more than 0.3 ° C above temperatures that would naturally occur.

C. Where it is not feasible to fully meet water quality standards Clean Water Act regulations allow Ecology to take action to remove or modify a designated use or to modify the criteria assigned to protect that designated use if other criteria would sufficiently protect that use. The process may involve a use attainable analysis and/or standard modification. However, the Chelan River has been dewatered for over 76 years and it is not currently known what level of support for fish and water temperature for such use can reasonably be achieved in the river. To make that determination, Ecology believes that the best approach is to proceed with a ten year adaptive management plan which will allow a sufficiently lengthy period of time to determine what level of fish support and water temperature is reasonable and feasible to achieve.

D. Ecology has worked collaboratively for a number of years with a relicensing team that includes the Chelan PUD, federal and state fishery resource agencies, and other stakeholders develop biological objectives to be achieved in the Chelan River. Those objectives identify three key species of fish (westslope cutthroat trout, steelhead trout and fall chinook salmon) for restoration or enhancement. The biological objectives and the initial measures that shall be implemented to attain those objectives are described in the Chelan River Biological Evaluation and Implementation Plan (CRBEIP revised April 18, 2003). Once those initial measures are implemented, regular monitoring and evaluation, as prescribed below, will be undertaken to identify any new measures or modification of the initial measures that may be necessary to achieve the objectives or effectively monitor and evaluate conditions. Changes to the implementation measures will be made in coordination with the Chelan River Fishery Forum (CRFF); however, Ecology retains authority to order additional changes or modifications to the extent necessary.

E. The adaptive management plan contemplates, at the end of the ten years or sooner, Ecology will determine whether Chelan PUD has undertaken all known, reasonable, and feasible measures to achieve the biological objectives, and if so whether water quality standards have been fully achieved. If Chelan PUD has undertaken such measures and water quality standards have not been fully achieved, Ecology will seek to resolve such non-compliance through a process to make site-specific and/or use-based rule changes to the water quality standards or such other process as may be consistent with state and federal law.

F. The intent of these actions is to support the goals of the State of Washington to "maintain the highest possible standards to ensure the purity of all waters of the state consistent with public health and public enjoyment thereof, the propagation and protection of wild life, birds, game, fish and other aquatic life, and the industrial development of the state, and to that end require the use of all known available and reasonable methods by industries and others to prevent and control the pollution of the waters of the state of Washington." (RCW 90.48.010).

G. The reference herein to the Lake Chelan Comprehensive Plan and specifically the CRBEIP (revised April 18, 2003), should not be construed to adopt or approve all of the opinions and statements of a factual nature that are contained therein.

III. Instream Flows for Fish

A. Minimum Instream Flow Requirements

i) The project shall provide and maintain the minimum instream flows for the Chelan River as described in the CRBEIP (revised April 18, 2003), Table 7-3. These flows are specified below. The definitions of dry, average and wet years are provided in Section 2.6.5 of the CRBEIP (revised April 18, 2003).

Reach	Dates	Dry year (cfs)	Average year (cfs)	Wet year (cfs)
1, 2 & 3[1]	July 16-May 14	**80** all months	**80**	**80**
	May 14		ramp up to **200**	Ramp up to **320**
	May 15-July 15		**200**	**320**
	July 16		ramp down to **80**	Ramp down to **80**
4[2] **Spawning flow**	March 15 - May 15; *and* Oct. 15 - Nov. 30	80 + 240 pumped (**320**)	**320** by combination of spill & pumping Incubation flow, as needed	**320** by combination of spill & pumping Incubation flow, as needed

[1] Flows measured at the dam by calibrated gate rating.
[2] Flows measured at the dam or through calibrated pump discharge curves.

ii) Minimum flows shall be provided by Chelan PUD as soon as the structures needed to provide such flows are constructed, which shall occur no later than two years after the effective date of the license. The structures to be constructed are a new flow release structure at the dam and modification to the channel in Reach 4.

iii) Instream flows shall be maintained in the bypassed reach of the Chelan River and in the tailrace, sufficient to meet water quality goals and standards for the waterway, as provided in Chapters 173-201A, 173-500 WAC, 90.48 and 90.54 RCW and meeting the biological objectives identified in section 4 of the CRBEIP (revised April 18, 2003).

iv) Prior to the date such structures are completed, Chelan PUD shall make good faith effort to provide flows that agencies may request for the purpose of testing designs or structures or of gathering other data, including any water quality data.

v) The minimum instream flow requirements set forth in this certification are considered minimum values and do not preclude other agencies with authority to require minimum instream flows higher than these.

vi) Higher flows may also be determined to be needed by the CRFF or by Ecology, as a result of studies performed as part of the CRBEIP (revised April 18, 2003).

vii) In order to assure continuing compliance with Chapter 173-201A WAC, Ecology retains the right to amend the instream flow requirements specified in this certification to provide adequate habitat and to meet the biological objectives for cutthroat in Reaches 1, 2 and 3 of the Chelan River, or for fall Chinook or steelhead in Reach 4 of the Chelan River, or any species included in the future on a state or federal listing of endangered or threatened species.

viii) This is a non-severable requirement of Ecology's certification. If it is rejected, in whole or part by the Federal Energy Regulatory Commission (FERC), Ecology's water quality certification for the Lake Chelan Project shall be deemed denied.

B. Ramping Rates

i) The project shall not exceed the following ramping rate for the purpose of preventing stranding of fish in the Chelan River, of two inches per hour, to be modified in consultation with the CRFF, as described in Section 3.2, table 7-6 of the CRBEIP (revised April 18, 2003).

C. Flow Security Criteria for Tailrace

i) The project shall adhere to the flow security criteria for the tailrace as described in Section 4.1.3, table 7-9, 7-10 and Sections 3.6, 4.1.3 and 5.5.1 of the CRBEIP (revised April 18, 2003). This condition is to prevent damage to salmon redds that may occur as a result of a powerhouse shutdown.

IV. Habitat Modifications and Biological Evaluation

A. Improvement of Habitat in Reach 4 and the Tailrace: No later than two years after the effective date of the license, Chelan PUD shall complete modifications to improve habitat in Reach 4 and the tailrace, as set forth in Section 3.1 and 3.2 respectively of the CRBEIP (revised April 18, 2003). The Chelan PUD shall use standard river habitat restoration techniques to accomplish the goals of providing and maintaining gravel areas for spawning, boulder placements for cover and pool formation, and increased structural roughness to moderate velocities and provide additional area and habitat diversity, as described in detail in Section 3.1, figures 7 through 9, and Section 3.2, figures 7 through 10 of the CRBEIP (revised April 18, 2003).

B. "As-Built" Plan: An "As-Built" plan shall be prepared by Chelan PUD after construction and/or modifications to improve habitat in Reach 4 and the Tailrace as set forth in Section 3 of the CRBEIP (revised April 18, 2003). The plan shall be of sufficient detail as necessary to support achievement of the biological objectives identified in Section 4 of the CRBEIP (revised April 18, 2003). The "As-Built" plan shall be included in the first Biological Objectives Status Report, submitted in year four.

Chapter 7
CRBEDP

LAKE CHELAN COMPREHENSIVE PLAN

Attachment B to the Lake Chelan Settlement Agreement

LAKE CHELAN HYDROELECTRIC PROJECT
FERC Project No. 637

October 8, 2003

Public Utility District No. 1 of Chelan County
Wenatchee, Washington

CHAPTER 7: CHELAN RIVER BIOLOGICAL EVALUATION AND IMPLEMENTATION PLAN

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EXECUTIVE SUMMARY

Chelan County Public Utility District No. 1 (Chelan PUD) has filed an application for a new license for the Lake Chelan Hydroelectric Project (Project) (FERC No. 637). The license application included several comprehensive plans for specific resource areas that were developed with the regulatory resource agencies and a number of other stakeholders through the collaborative Alternative Licensing Procedure (ALP). A number of the agencies and stakeholders filed with FERC as intervenors in the licensing process. All intervenors were invited to participate in a Settlement Group, with the intent of developing a long-term settlement agreement for the Project. The Lake Chelan Hydroelectric Project Settlement Agreement (Agreement) will be submitted to FERC for approval and incorporation into the New License. The individual comprehensive plans have been consolidated into a single document, the Lake Chelan Comprehensive Plan (Comprehensive Plan). The Comprehensive Plan is a key element of the proposed Agreement, with the intent to document the measures that will be employed to protect and enhance natural and social resource values within the area affected by the Project.

Section 401 of the Clean Water Act requires that license applicants apply for state certification of compliance with water quality standards and other appropriate requirements of state law. The purpose of the Section 401 process is to protect and enhance the beneficial use of state waters. The State of Washington Department of Ecology (WDOE) is responsible for issuing the Section 401 certification for the Project, or waiving such certification. WDOE is a participant in the Settlement Group, and has requested that Chelan PUD provide the biological basis for the portion of the Comprehensive Plan that protects water quality and the beneficial uses of Lake Chelan and the Chelan River. This document, Chelan River Biological Evaluation and Implementation Plan (CRBEIP), is in response to that request.[1] The CRBEIP has been incorporated as Chapter 7 of the Comprehensive Plan.

Chelan PUD's pending license application to FERC will be the third license for operation of the Project, and the second Section 401 certification. In the previous two licenses and Section 401 certification, the Project was not required to provide a minimum flow to the Chelan River. The bypassed reach (i.e., the portion of the Chelan River between the intake structure at the dam and the confluence of the river and the powerhouse tailrace), has been dry for most of the year for the past 76 years. Although the Chelan River is classified as a Class A waterbody (by virtue of that fact that all streams in Washington are designated as Class A unless specifically designated otherwise), this river has not supported Class A designated uses since before the enactment of the Clean Water Act and Washington State's water quality standards.

The CRBEIP would restore flows to the bypassed reach of the Chelan River, thereby supporting the beneficial uses that are typical of Class A waterbodies. The Comprehensive Plan, including the CRBIEP and other chapters, would protect both the existing beneficial uses of Lake Chelan (fish and wildlife, recreation, and power production), and provide new beneficial uses in two

[1] The CRBEIP is also submitted as a "mitigation plan" pursuant to the Washington State "Aquatic Resources Mitigation Act" (RCW 90.74.005 to RCW 90.74.030)

distinct portions of the bypassed reach. The intent of the CRBEIP is to a) evaluate the biological effects of the minimum flows and other actions from all perspectives, seeking a balance between the biological requirements and other beneficial uses of the Lake Chelan watershed; and b) maintain, support and protect existing beneficial uses as required by state and federal laws.

In the upper portions of the bypassed reach, the proposed minimum flows would provide an opportunity for aquatic species of fish and other organisms to inhabit what has been a dry river bed. In the lowest portion of the bypassed reach, the CRBEIP would significantly enhance salmon and steelhead trout spawning habitat. This enhanced habitat would be immediately adjacent to an area below the confluence of the bypassed reach and the tailrace, where salmon and steelhead trout currently spawn. The net effect of the CRBEIP is to provide significantly improved biological functions and values compared to existing conditions, restoring aquatic life uses to the bypassed reach of the Chelan River.

The Chelan River is classified as a Class A surface water under Washington State's water quality standards. However, this classification was made by default under a provision in the water quality standards which provides that "[a]ll other unclassified surface waters within the state are hereby classified Class A." Thus, the Class A designation of the Chelan River is arbitrary in the sense that it is not based on any examination of the environmental conditions in the river, or the existing beneficial uses of the river.

Water temperatures recorded (1994 – 2002) in the Chelan River, upstream from the Project, are often in excess of temperatures that typically are expected in a water body classified as a Class A surface water. The Washington State water quality standard for the Class A waterbodies (WAC 173-201A-030) states that: "Temperature shall not exceed 18.0°C (freshwater) or 16.0°C (marine water) due to human activities. When natural conditions exceed 18.0°C (freshwater) and 16.0°C (marine water), no temperature increases will be allowed which will raise the receiving water temperature by greater than 0.3°C. Incremental temperature increases resulting from point source activities shall not, at any time, exceed t=28/(T+7) (freshwater) or t=12/ (T-2) (marine water). Incremental temperature increases resulting from nonpoint source activities shall not exceed 2.8°." The 18°C numerical temperature criterion for freshwater is a biological benchmark that signifies when water temperatures begin to exceed the preferred temperature range for cold water salmonid fish species. These fish species can tolerate water temperatures well above 18°C for periods of time and many surface waters that support salmonid populations routinely reach higher temperatures during the day in summer. However, these warmer temperatures can reduce growth and disease resistance and, in the extreme, can be lethal to salmonid fish if they occur too frequently or persist for too long.

A primary beneficial use of Class A surface waters is habitat for salmonid fish. This beneficial use currently exists in the lower portion of the Chelan River at and below the confluence with the tailrace. Rainbow trout from hatchery releases have also been observed in the upper Chelan River above the dam. However, there is no historical documentation of native salmonid (cutthroat trout) populations in the Chelan River below the dam site prior to construction of the Project. Based on current temperature measurements in Lake Chelan and the Chelan River above the Project, and the results of temperature modeling, it is probable that water temperatures during summer in the Chelan River were substantially warmer than 18°C prior to construction of

the Project. Historically, cutthroat trout populations may have been limited to seasonal or transitory use of the Chelan River by these warm temperature conditions. Water temperatures recently recorded (1994 – 2002) in the Chelan River exceed 18°C for most of June through September, with temperatures recorded as high as 24°C in some years. Clearly, this temperature regime does not constitute ideal habitat for cold water fish species, such as cutthroat trout. However, the CRBEIP includes the biological objective of providing habitat for cutthroat trout, to the extent feasible, given the high water temperatures coming from Lake Chelan and the need to maintain and protect the existing beneficial uses of Lake Chelan and the Chelan River.

The flow regime in the CRBEIP is the preferred alternative of a number of flow options considered for preservation of existing beneficial uses (fish populations in Lake Chelan, recreation, salmonid spawning below the tailrace, hydroelectric power generation), as well as providing opportunity for beneficial uses that currently do not exist (salmonid spawning and rearing in the lower Chelan River, cutthroat trout and native cool water species in the upper Chelan River, aquatic ecosystem, and wildlife habitat). A number of habitat enhancement measures are included in the CRBEIP to increase the likelihood of achieving these biological objectives. These measures include actions to increase the amount of physical habitat for fish and to moderate the warming of water temperatures in the Chelan River to the extent feasible while maintaining and protecting existing beneficial uses.

The CRBEIP's flow regime for the Chelan River rests on a strong scientific basis. As demonstrated by temperature modeling, the water temperatures under any flow regime will greatly exceed the preferred temperature zone for cutthroat trout in the upper Chelan River, and for chinook salmon and steelhead trout in the lowest reach of the river. Thus, the biological impact of marginally reducing those relatively high water temperatures could be limited (R2 and IA 2000; Sternberg 1987; Wydoski and Whitney 1979; Scott and Crossman 1974; Milstein 2000; WDFW 1992; NOAA Fisheries 1996). In addition, the high flows that would be necessary to limit temperature increases to 0.3°C, as allowed in the water quality standard, would provide less useable area of physical habitat with the depths and velocities preferred by target fish species than will be provided by the flow regime proposed in the CRBEIP.

Put another way, limiting temperature increases to 0.3°C could diminish, rather than enhance, the overall value of the aquatic habitat for fish and would also dramatically impair existing beneficial use of these waters for power production and lake recreation. Based on information collected to date, the lower flows provided under the CRBEIP provide useable physical habitat area for fish, the ability to maintain plant cover for shade and food sources, greater cooling at night under the proposed flows, and a potentially greater likelihood of cool water refugia forming where sub-surface flows and ground water enter the river channel. Also, the adverse effect of the CRBEIP's flow regime on other existing beneficial uses (primarily recreation and power generation) is significantly less than a regime of higher flows. The evidence suggests that the CRBEIP will provide greater biological benefits than would occur if temperature fluctuations were further limited by providing substantially higher flows in the Chelan River.

The temperature modeling determined that flows in the range of 1,500 cfs - 2,000 cfs (the hydraulic capacity of the powerhouse) would be required to limit temperature increases above "natural" to not exceed 0.3°C. In order to provide this level of flow from June through

September, the Project would be forced to reduce generation or shut down entirely for most of this period, except in high flow years when the Project could continue to operate in June and July. This would be a dramatic impairment of the existing beneficial use of the waters of Lake Chelan for power production and recreation. For example, a 2,000 cfs flow during these four months was modeled and resulted in an average energy loss of 70,656 MWh/year. The net present value of such a loss, over a 50 year period, would be approximately $50,000,000. The provision of this flow in June also has the potential to delay refill, with impairment of the existing beneficial use of the lake for recreation by limiting utility of docks and launches. Lesser amounts of flow would have reduced costs, but would exceed the 0.3°C allowance.

Model predictions indicate that even with flow releases of 1,500 – 2,000 cfs, the temperature would still exceed 23°C during a significant period of time each year. The daily maximum temperature exceeded 23°C on 14 percent of 2125 data points modeled for flows of 1,500 cfs – 2,000 cfs (Appendix A). These data points included 5 locations in the Chelan River, covering the period from May 1 – September 30, 2000 – 2002 and 14 hot summer days in 1998. At 1,500 cfs for the days from May 1 – September 30, 2000-2002 (411 days), the model predicts that daily maximum temperatures at the bottom of Reach 3 would exceed 25°C on five days, 24-25°C on fourteen days and 23-24°C on 58 days (total 77 days). Natural inflow to the Chelan River averages less than 1,500 cfs by the middle of August, thus natural conditions could be warmer in low flow years, as predicted by the model. Due to high velocities and hydraulic action, there would be no thermal refugia and the model predicts insignificant nighttime cooling at these higher flows, thus limiting the biological benefit to aquatic life of higher flows.

The CRBEIP includes a number of options that could be employed to reduce peak temperatures, if needed and feasible. The CRBEIP also includes an extensive monitoring and evaluation program to determine if biological objectives are achieved and, if not, trigger decisions to implement options to remedy specific causes of failure to meet biological objectives. For example, the CRBEIP provides for flow increases during extremely hot weather if increased flows are necessary to achieve the biological objectives. With the benefit of nighttime cooling, during much of the summer the aquatic community would spend fewer hours in temperatures in the upper tolerance zone under the CRBEIP than would occur with higher flows, which the model predicts would yield constantly high water temperatures 24 hours per day.

Implementation of the CRBEIP is designed to support, maintain and protect the designated and existing beneficial uses of the Chelan River Basin, pursuant to applicable federal and state law. The CRBEIP defines the biological objectives that constitute protection of the designated and existing aquatic life beneficial uses in the Chelan River. At or before year 10 of implementation of the CRBEIP, if WDOE determines that the biological objectives have been met but non-compliance with water quality standards exists, WDOE intends that it will initiate a process, if necessary, to modify the applicable standards through rulemaking or such alternative process as may otherwise be authorized under applicable federal and state law. If WDOE determines that some or all of the biological objectives have not been met and that Chelan PUD has undertaken all known, reasonable, and feasible measures to achieve those objectives consistent with supporting, protecting, and maintaining the designated and existing beneficial uses, WDOE intends to initiate a process to modify the applicable water quality standards to the extent necessary to eliminate any non-compliance with such standards.

The scientific data clearly shows that the 18°C temperature preference for salmonids is not attainable in the summer under any flow condition. As shown with modeling, temperatures at natural inflow would exceed 23°C during much of the summer. The consequence of trying to meet the water quality standard (natural temperature plus 0.3°C) would be that essentially no hydroelectric generation would be allowed during much of the summer, when power demand for air conditioning and industrial use is high. The economic consequences and impairment of existing beneficial uses would be high, yet the biological benefit of meeting the water quality standard, considering the naturally high water temperatures, is predicted to be no greater than provided under the CRBEIP, The instream flows, habitat enhancements and other actions in the CRBEIP are predicted to provide considerably greater biological benefits, while protecting other beneficial uses, than would a flow regime that merely meets the numeric temperature criteria.

SECTION 1: INTRODUCTION

The Lake Chelan Project is located on the Chelan River near the city of Chelan, Chelan County, Washington. The 48-megawatt Project has a total average annual generation of 380,871 megawatt hours. It occupies 465 acres of land managed by the USDA Forest Service and the National Park Service (NPS). The license for the Project will expire on March 31, 2004. On July 6, 1998, FERC granted Chelan PUD's request to use ALP for the development and submission of an application for a new Project license. The ALP provides for early stakeholder involvement in decision-making related to protection, mitigation and enhancement measures (PMEs) for ongoing Project impacts.

As part of the collaborative process, a total of 115 working group meetings and 39 full relicensing team meetings were held between April, 1998 and March, 2002. In accordance with the ALP, Chelan PUD, federal and state agencies, local tribes and the public formed the Natural Sciences Working Group (NSWG)[2] and the Social Sciences Working Group (SSWG) to develop management plans for the natural and recreational resources of Lake Chelan and the Chelan River. The SSWG developed a Recreation Resources Management Plan (RRMP, December 7, 2001) and the NSWG developed two proposals: the Lake Chelan Comprehensive Fishery Management Plan (CFMP, December 7, 2001) and the Chelan River Comprehensive Management Plan (CRCMP, December 7, 2001).

Chelan PUD filed an application for a New License with FERC on March 28, 2002. Subsequently, a Settlement Group[3], representing the intervenors to the FERC licensing process, has developed a long-term Agreement for the Project. Signatories to the Agreement will be the Parties. The Agreement is intended to document a strong commitment by all of the Parties to achieve consensus regarding the relicensing of the Project. The Agreement will be submitted to the FERC for approval and incorporation into the New License. In addition to the Agreement, the Settlement Group has updated and combined the various comprehensive plans into a single document titled the Lake Chelan Comprehensive Plan (Comprehensive Plan). Each of the previous comprehensive plans has been updated to reflect changes resulting from the ongoing settlement negotiations. This CRBEIP is Chapter 7 of the Comprehensive Plan.

Section 401 of the Clean Water Act requires that license applicants apply for state certification of compliance with water quality standards and other appropriate requirements of state law. The purpose of the Section 401 process is to protect and enhance the beneficial use of state waters. The State of Washington Department of Ecology (WDOE) is responsible for issuing the Section

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[2] The broad-based working group includes the NOAA Fisheries; the Washington Department of Fish and Wildlife; the U.S. Fish and Wildlife Service; the USDA Forest Service; the National Park Service, the Washington Department of Ecology, the Colville Confederated Tribes and Yakama Nation, the Lake Chelan Sportsman's Association, the People for Lake Chelan, Chelan County PUD, and other interested parties.

[3] All intervenors were invited to participate in the Settlement Group including the Department of Agriculture (USDA Forest Service), Department of Interior (NPS and USFWS), Department of Commerce (NOAA Fisheries), Washington State Attorney General Office (WDFW and WDOE), city of Chelan, American Rivers and the Columbia River Inter-Tribal Fish Commission

401 certification for the Project, or waiving such certification. The certification process considers the Project's compliance with the Clean Water Act and other appropriate requirements of state law, including what measures can be employed to protect, restore and enhance the existing beneficial use of the waters associated with the Project. These uses include propagation of fish and wildlife species, recreation, generation of electricity, and irrigation. WDOE, through the Section 401 certification, may require that certain specific actions or measures be included in the Project's license to achieve that objective.

Chelan PUD applied for Section 401 certification in a letter dated March 26, 2002. This request was submitted to FERC with the license application. WDOE provided public notice in December 2002 of its intent to provide FERC with a Section 401 certification for the Project. This CRBEIP provides the basis for WDOE's analysis of the measures in the Agreement that are intended to preserve, restore and enhance the beneficial use of the waters of Lake Chelan and the Chelan River bypassed reach. WDOE issued a Section 401 certification and Order, using implementation of the CRBEIP as one component for compliance in the Order, on March 24, 2003.

SECTION 2: BACKGROUND

2.1 Current Operations

Chelan PUD operates the Project between water surface elevations of 1,100 and 1,079 USGS, although the lake is maintained above elevation 1,098 for most of the summer recreation period. The lake is drawn down annually to allow flood control and for storage of spring snowmelt. The drawdown typically begins in early October, and the lowest lake level typically occurs in April. The lake is refilled through May and June, with a goal to reach elevation 1,098 on or before June 30. The lake is maintained above elevation 1,098 through September 30. Of the 677,400 acre-feet of usable storage, 65,000 acre-feet is reserved for irrigation and municipal and domestic water supplies. When inflows exceed the hydraulic capacity of the powerhouse units (2,300 cfs), water may be spilled over the spillway into the bypassed reach of the Chelan River. Spills usually occur during May, June and July. The Project historically has been operated to reduce peak flood flows in the Chelan River. The existing license and Section 401 certification for the Project does not require instream flow releases into the bypassed reach.

The Chelan River extends from the dam downstream to the Columbia River for approximately 3.9 miles. The Chelan River can be divided into four reaches based upon gradient, confinement, and fluvial geomorphologic characteristics (Figure 7-1). These are described as follows.

- *Reach 1.* This upper-most section extends from the diversion dam (Lake Chelan outlet) downstream for 2.29 miles (Figure 7-1). The bed of this low gradient (1%) section is primarily composed of large cobbles and small boulders, with gravels generally limited to the margins of the river channel. This reach of the Chelan River is moderately confined by hillslopes composed of glacial moraine deposits. These deposits are easily erodable, and represent a substantial source of sand and gravel to the river channel. Most of these fine bed materials are flushed out of the river during annual spill events. Streamside vegetation is scarce along this reach of the river, and is mainly present as patches of cottonwoods and alders and isolated conifer stands. The upper reaches of this channel are relatively wide, with average channel widths between 100 and 140 ft. The channel becomes narrower in the middle of Reach 1. The channel becomes considerably wider in the lower most reach, spreading into multiple channels.

- *Reach 2.* This 0.75-mile long section is located in the upper end of the Chelan River Gorge (Figure 7-1). The gradient in this section is similar to Reach 1. This section of the river, however, is confined by steep hillslopes. Consequently, the river channel in Reach 2 is much narrower than in Reach 1. Substrates are dominated by large cobbles and boulders, and are larger than those in Reach 1. There is very little streamside vegetation present in this reach of the Chelan River.

- *Reach 3.* This is the gorge section of the Chelan River (Figure 7-1). Reach 3 is 0.38 miles in length, and is characterized by a steep gradient (9%) channel that is located in a narrow canyon confined by steep bedrock walls. The river channel becomes as narrow as 15 to 20 ft wide through the gorge section. The high water velocities produced in this steep and narrow canyon flush through all bed materials except for large boulders. Consequently, much of the

river bottom is bedrock, resulting in generally poor habitat conditions. There are several deep plunge pools (20 ft to 30 ft depth) found below waterfalls and steep bedrock cascades. These pools retain water and provide some aquatic habitat. At least five physical features (waterfalls) in this section block anadromous fish access to Reaches 1 and 2 (see section 2.6.3).

- *Reach 4*. This 0.49-milelong section of the Chelan River extends from the mouth of the gorge to the powerhouse tailrace (Figure 7-1). Reach 4 has a low gradient of 0.4 percent. As a result of its low gradient and relatively unconfined channel, Reach 4 is an active alluvial zone where gravels and cobbles originated from the highly erosive banks in Reaches 1 and 2 are deposited after being flushed through the gorge. Substrates in Reach 4 are mainly composed of small and large cobbles and large gravels. The river channel in this reach widens rapidly as it exits the gorge and enters the Columbia River floodplain. Reach 4 becomes very wide, splitting into multiple channels, about 1,000 ft upstream of the backwater of the Columbia River. The Chelan River stream bed is very dynamic in this multiple-channel section during the annual spill period in the spring.

Under present operations, the bypassed reach of the Chelan River provides no year-round fish habitat for resident or anadromous species, except for a few groundwater-fed pools in Reaches 1, 2, and 3.

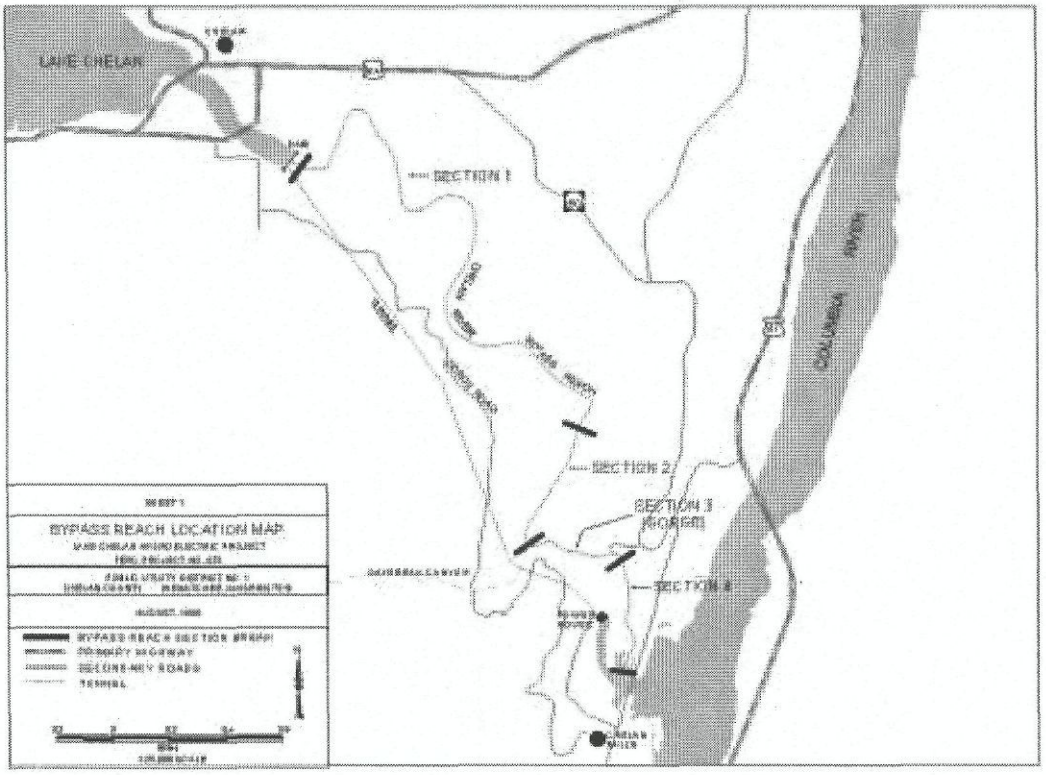

Figure 7-1: Bypass Reach Location Map

2.2 Lake Chelan - Water Quality

Lake Chelan is an ultra-oligotrophic lake characterized as nearly pristine, with few identified water quality limitations. In order to maintain this high-level water quality, Lake Chelan has a Total Maximum Daily Load (TMDL) for phosphorus, the primary nutrient limiting factor for algal growth. Other water quality concerns previously noted in earlier studies included localized water quality effects attributed to non-point sources of bacterial input and pesticides. Information collected during monitoring of Lake Chelan in 1999 suggests that water quality conditions in the lake have been very stable since baseline monitoring began in 1987. Phosphorus loading into the Wapato Basin "appears to have remained fairly constant between 1987 and 1999" (Anchor Environmental 2000). The report also indicated that lake level fluctuations resulting from current Chelan PUD operations appear "unlikely to have a direct or indirect effect on TP or fecal coliform levels in Lake Chelan" (Anchor Environmental 2000).

Early in the relicensing process, the NSWG approved a plan for the study of baseline water quality conditions in Lake Chelan, the Chelan River, and the Project tailrace. The intent of the study, conducted in 1999, was to evaluate the Project's effects on water quality parameters in the watershed. The parameters measured in this study were compared to baseline studies conducted in 1987 (Patmont et al. 1989), and follow-up investigations (Congdon 1996; Sergeant 1997). In 2000, Anchor Environmental presented its findings in a report to the NSWG.

The study found that water quality parameters in Lake Chelan are within Washington State water quality standards, and are not adversely affected by operation of the Project.

2.3 Lake Chelan – Lake Levels

In preparation for the New License, both the NSWG and the SSWG focused on lake level operations in terms of its relation to recreational objectives and protection and enhancement of native fish species. Protection of native species and management of the lake level to enhance tributary fish production and recreation have direct bearing on the issue of water quality certification. Chapter 8 of the Comprehensive Plan sets forth a proposal for lake level management, a primary goal of which is to enhance habitat for the native species of primary interest, the Westslope cutthroat trout. Provision of suitable habitat for this species is also a primary desired beneficial use for the upper two reaches of the Chelan River.

The lake level management regime balances the needs of the native fish resources with the social benefits of recreation and electricity generation. Under the proposal (summarized in Table 7-1), the lake would remain full during the prime recreation season of July into September. The draw down of the lake would begin in September in order to expose alluvial deposits at the mouths of lake tributaries to the channel carving action of tributary flows during the fall rainy period in November and early December. The spring refill schedule is designed to provide access to the tributaries for spring spawning cutthroat trout, and to achieve usable lake levels for recreational boating in June. It is also intended to maintain sufficient storage capability to moderate high runoff releases into the Chelan River, preventing scouring of fish habitat that can occur at very high flow levels. The refill schedule and maintenance of full lake levels during summer affect both power generation and flow releases into the Chelan River.

Table 7-1: Average lake levels (feet, USGS) for the original license, existing license, and proposed lake level cycle (Chelan PUD 2001b)

Day	Original License (1927-1981)	Existing License (1981-2000)	Working Group Proposal[1]
January 1	1090.7	1091.7	1089.2
February 1	1088.4	1089.2	1087.1
March 1	1086.6	1087.1	1085.7
April 1	1085.6	1086.3	1085.4
May 1	1087.6	1088.0	1087.8
June 1	1094.8	1094.4	1095.2
July 1	1099.3	1099.2	1099.3
August 1	1099.7	1099.7	1099.7
September 1	1098.8	1099.5	1098.9
October 1	1096.9	1098.3	1097.4
November 1	1094.7	1095.8	1094.3
December 1	1092.9	1094.2	1091.8

[1] Natural Sciences Working Group (PME14)

The lake level management approach is intended to moderate high runoff. The proposed approach will prevent excessively high spill levels and provide a number of advantages,

including: 1) reduced impacts on aquatic biota in the bypassed reach of the Chelan River from high peak spill levels; 2) benefits to aquatic biota by providing conditions in the bypassed reach of the Chelan River that more closely mimic the natural hydrograph; 3) more flow in the tailrace in early spring (April and May) for steelhead egg incubation and fry emergence; and 4) reduced impacts on power generation.

2.4 Lake Chelan – Recreation

Recreation is a major designated, existing use of Lake Chelan, and Chapter 11 of the Comprehensive Plan contains a number of recreational improvements and enhancements for public access and use of Lake Chelan during the prime recreation season. Other than short-term effects of construction (dock repairs, shoreline stabilization, etc.), most of the recreation enhancements on the lake have no relationship to water quality, with the exception of commitments to refill the lake earlier in the summer

2.5 Chelan River – Recreation

An additional recreational component, trail access to the Chelan River, relates directly to the beneficial uses and water quality of the Chelan River. Chelan PUD will provide access to the Chelan River through the development and implementation of a non-motorized, non-paved, multi-use trail just below the dam (Reach 1) in the Chelan River bypassed reach. The trail will be constructed out of the high water and shoreline zone, thus preventing any adverse effects to water quality from the construction. The trail will improve the opportunities for recreational use and enjoyment of the aesthetic improvements to the Chelan River resulting from the flows and channel enhancements being proposed.

2.6 Chelan River Biological Evaluation and Implementation Plan

The CRBEIP has been developed by Chelan PUD in cooperation with the NSWG as a balanced approach to restoring the Chelan River to provide a functional riverine ecosystem capable of supporting native fish species while maintaining the existing beneficial uses of the waters of Lake Chelan and the Chelan River by the Project for lake recreation and generation of electricity. As outlined in the above description of current Project operations, there is currently no year-round instream flow in the bypassed reach of the Chelan River. Under the CRBEIP, a year round instream flow would be provided for the first time in approximately 75 years.[4]

In coordination with the NSWG, Chelan PUD funded a number of studies in the Chelan River bypassed reach to examine the effects of various flow regimes on instream habitat for native and introduced fish species. The studies included an analysis of limiting factors such as water temperature, food resources, and barriers to anadromous fish.

2.6.1 Instream Flow Incremental Methodology (IFIM)

The Instream Flow Incremental Methodology was used to compare the amount of usable habitat for various native species at different flows through the Chelan River (R2 and IA 2000). In general, the instream flow analysis found that habitat availability in the upper two reaches of the Chelan River was greatest at flows between 60 cfs and 240 cfs for cutthroat trout and suckers (representative of native cool-water species) (Table 7-2). The habitat area for suckers was higher

[4] The existing dam and powerhouse were completed by 1927.

at the lower end of the flow range, while cutthroat habitat area was greater at the upper end of the range. Total useable habitat area for both cutthroat and suckers was optimized at flows in the range of 80 cfs – 160 cfs. Flows at higher levels resulted in substantial reductions in useable habitat area, with the combined habitat area for cutthroat and suckers reduced to 80% of maximum area when flows were 600 cfs. The habitat area for cutthroat in Reach 1 was estimated for flows up to 5,000 cfs (R2 and IA, 2000), but useable habitat area for cutthroat was reduced to 20% of maximum at that flow level.

Table 7-2: Total habitat area (acres) versus flows in Chelan River

	Reach 1		Reach 2			% of
Flow (cfs)	Cutthroat	Sucker	Cutthroat	Sucker	Total	Maximum
40	2.59	4.53	1.12	1.68	9.92	73%
60	3.58	5.30	1.43	1.62	11.93	88%
80	4.34	5.58	1.59	1.47	12.98	95%
100	5.00	5.51	1.66	1.30	13.47	99%
120	5.51	5.30	1.67	1.14	13.62	100%
140	5.88	4.98	1.64	0.96	13.46	99%
160	6.09	4.68	1.59	0.79	13.15	97%
180	6.22	4.41	1.52	0.66	12.81	94%
200	6.31	4.18	1.44	0.57	12.50	92%
220	6.34	4.00	1.35	0.50	12.19	90%
240	6.33	3.87	1.28	0.46	11.94	88%
260	6.31	3.74	1.21	0.43	11.69	86%
280	6.32	3.64	1.16	0.42	11.54	85%
300	6.30	3.58	1.12	0.40	11.40	84%
400	5.98	3.55	0.96	0.17	10.66	78%
500	5.71	3.89	0.89	0.15	10.64	78%
600	5.71	4.22	0.86	0.16	10.95	80%
1,000	4.18	[1]	[1]	[1]	4.18[1]	66%[1]
2,000	3.16	[1]	[1]	[1]	3.16[1]	50%[1]
5,000	1.65	[1]	[1]	[1]	1.65[1]	26%[1]

[1] The estimated habitat area for flows above 650 cfs was not reported in R2 and IA, 2000. The total and percent of maximum habitat at flows of 1,000 - 4,000 is limited to habitat area for cutthroat trout in Reach 1. Source: R2 and IA 2000.

In Reach 4, the primary management interest of the NSWG was to provide habitat for spawning, incubation, and early rearing of anadromous chinook salmon and steelhead trout. In the existing channel, estimated usable area for spawning of these species was highest at a flow of 650 cfs. The total usable habitat area is scattered in small pockets and estimated to amount to no more than 2.8 acres for chinook and 2.2 acres for steelhead (R2 and IA 2000). Useable spawning habitat in the tailrace, where chinook currently spawn, was estimated to be 2.1 acres for chinook and 1.3 acres for steelhead at a powerhouse discharge of 2200 cfs.

2.6.2 Limiting Factors

The limiting factors analysis (R2 and IA 2000) indicated that natural conditions would be limiting to salmonid fish production in the Chelan River. These factors included unfavorable water temperatures entering the Chelan River from Lake Chelan in the summer; low nutrient

levels in the water coming into the River from ultra-oligotrophic Lake Chelan and limited input of terrestrial organic matter; low abundance of invertebrates as a result of the low fertility and warm summer water temperatures; low availability of spawning gravel; and high potential for gravel scour during high flow spill events. The Chelan River receives water from Lake Chelan at temperatures that exceed the temperature that results in zero net growth (19°C) for trout and salmon from July through the early part of September (R2 and IA 2000).

Baseline data was collected by Anchor Environmental at four locations in the Chelan River: 1) upstream of the Project's intake; 2) discharge through the powerhouse; 3) water spilled into the bypassed reach of the Chelan River; and 4) mixed tailrace and bypassed reach water entering the Columbia River.

The study determined that water quality in the Chelan River upstream of the intake exceeds temperature criteria for Class A waterbodies during the summer months due to natural conditions at the lake outlet. These warm water temperatures resulted from natural lake stratification and associated seasonal warming of the epilimnion. Water temperatures at the lake outlet located upstream of the Project's structures ranged from 15.3°C to 21.0°C during the summer of 1999. During seven of the eight sampling events from June 2 through August 17 of that year, water temperatures entering the bypass reach exceeded 18°C (Anchor Environmental 2000).

The study compared water temperatures at the lake outlet to temperatures in the lower reach of the bypassed Chelan River and at the tailrace. During the seven sampling events, there was no significant change in temperature for water passing through the powerhouse into the tailrace. In other words, water passing through the intake, penstock, powerhouse, and into the tailrace was found to be the same temperature as water entering the intake. The study indicates that power generation does not adversely affect water quality discharged from the powerhouse. In fact, during the periods of the year when water temperature was greater than 18°C, water passing through the powerhouse remains cooler during the warmest parts of the day than would water passing through the bypassed reach of the Chelan River, which would be subject to further warming from solar radiation and contact with warm air (Anchor Environmental 2000).

Under these natural limiting conditions, the temperature of water spilled into the bypassed reach increased in seven of the sample flow levels (ranging from 80 to 3,600 cfs.) tested as part of the studies commissioned by the NSWG. The mixed temperature of the Chelan River below the confluence of the tailrace discharges and the bypassed reach was calculated using simple heat balance models and a constant total outflow (tailrace + bypass) of 2,000 cfs. The lowest temperature of the Chelan River below the confluence occurs when no water is diverted through the bypassed reach (Anchor Environmental).

The water temperature monitoring conducted in 1999 presents a brief "snapshot" of water temperature in the Chelan River. Additional data from the Project powerhouse (continuous samples from 1994-1998 (Figure 7-2) and monthly samples from 1960-1994 (Figure 7-3)) illustrates that water temperature at the lake outlet has historically been a limiting factor. This water temperature information was extensively supplemented in 2002, when baseline information was collected for calibration of the temperature model. Water temperatures were collected every 30 minutes from seven locations, the Chelan River at the upstream face of the

dam, at the end of the spill apron, at the ends of reaches 1, 2, 3 and 4 of the bypassed reach and in the powerhouse discharge. The water temperatures were collected over a broad range of flows (80 cfs – 6,000 cfs) between June 11 and August 20. This temperature data is summarized in Appendix A of the CRBEIP. Additional continuous water temperature information will be conducted throughout the monitoring and evaluation period of the CRBEIP, which will be used to assess the interaction between water temperature, Project operations and biological response of the aquatic organisms in the Chelan River.

2.6.3 Barrier Analysis

The barrier analysis study by R2 and IA (2000) concluded that five natural barriers evaluated in the study would be impassible to steelhead trout and other anadromous salmonid species at most flows. Three of the barriers were impassible at all flows based on passage criteria for steelhead trout. Based on these results and the lack of historic evidence indicating the presence of anadromous fish in Lake Chelan (Hillman and Giorgi 2000), the Chelan River is only suitable for anadromous fish in Reach 4. For this reason, the NSWG decided to manage the upper three reaches of the Chelan River for native, non-anadromous species, and to focus the management of Reach 4 on the anadromous species.

2.6.4 Considerations and Investigations of the Working Group

The NSWG debated at length the benefits and detriments of two alternative concepts for restoration of the Chelan River. One option was to provide flow levels that maximized useable habitat area in the existing flood-scoured river channel while recognizing that the area had poor habitat characteristics. The second option was to use a lower flow while enhancing physical habitat and constructing a new streambed (side channel) protected from high flow scour.

The NSWG sought the services of Stillwater Sciences, a consulting firm experienced in fluvial geomorphology and watershed and river restoration projects, to conduct an independent evaluation of the potential for restoration of the Chelan River. The NSWG directed the consultant to develop a contractor-recommended alternative for instream flows and stream habitat restoration after reviewing the alternative concepts, information gathered from relicensing studies pertinent to the issue, and scientific literature. The NSWG (with principal direction from the regulatory agency caucus[5]) developed six objectives for restoration of the Chelan River. The objectives presented to Stillwater Sciences were:

- Establishment of Westslope cutthroat trout populations in the upper reaches;
- Establishment of instream flow;
- Development of ecosystem parameters that reflect seasonal variations in flow;
- Establishment of summer steelhead and summer/fall chinook salmon populations in the lower reach;
- Physical habitat modifications in the lower reach; and
- Assurance that physical habitat modifications and perennial flows result in negligible effects on lake fisheries and lake elevations while continuing to provide flow for power production.

[5] The regulatory agencies formed a caucus committee to deliberate on instream flow issues as they related to their respective management responsibilities. The "caucus" reported joint regulatory agency positions on flow recommendations to the NSWG.

The caucus put the highest priority on maintaining a perennial flow regime that reestablishes naturally functioning ecosystems in the Chelan River. The second priority was management of Reach 4 for summer/fall chinook and steelhead. The third priority was management of Reaches 1, 2 and, 3 for cutthroat trout and other indigenous species.

Stillwater Sciences performed an extensive review of the hydrological, geological, water quality and biological factors that will influence the restoration of the Chelan River and the attainment of the objectives stated. It determined the most significant factors to be the following:

- The mean monthly flow of the river under natural conditions ranged from 641 cfs in winter to peak flows in June-July of 6,462 cfs (1.5 year frequency) to 15,174 cfs (10 year frequency);

- The effect of storage and winter generation reduced the magnitude of peak annual flows in low flow years (34% from 6,462 cfs to 4,262 cfs). However, the Project had less of an influence on the magnitude of peak flows in high runoff years;

- The bedload properties of the Chelan River are anomalous relative to other rivers because it has the flow regime of a 924 square mile basin, but only derives sediment from the lower 4.0 miles of the river. Sediment is very coarse and transported only during very high flow events. It is delivered to the channel via local mass wasting events or erosion of the bed and banks;

- Reach 4 is a braided alluvial fan, potentially very unstable and characterized by large cobbles and boulder substrate constituting 94 percent of the wetted area during moderate flows (650 cfs);

- Mean monthly temperatures in Lake Chelan range from 4°C in the winter to over 20°C in July, and the water temperatures in the Chelan River follow the same trend, which is a function of the morphology of Lake Chelan;

- Water entering the Chelan River is low in phosphorous and other nutrients;

- The majority of vegetation in the Chelan River corridor is not riparian, but rather dry land adapted shrub steppe community. Pre-Project historical photographs indicate the composition, extent, and condition of riparian vegetation are substantially unchanged since the pre-Project period;

- The potential width of the riparian zone and density of riparian vegetation independent of baseflow conditions is constrained. The arid climate, steep moisture gradient in the soil at the active channel/floodplain boundary, and high scouring forces during peak flows likely exceed the physiological limits of long-term survival for most riparian plants.

- Macroinvertebrate production will likely be limited by a combination of low nutrient levels, limited allochthonous inputs of organic material due to limitations to development of riparian vegetation, and high water temperatures;

- Long-term data from powerhouse records indicate that the water temperatures in the tailrace (representative of water entering the Chelan River from Lake Chelan) often exceed the optimal growth threshold for chinook and cutthroat from May through mid-October, and regularly exceed the level for zero net growth of fish. These temperatures are the result of lake conditions, not an effect of the Project.

As directed by the NSWG, Stillwater Sciences investigated three flow levels for rearing (80, 115 and 150 cfs) and four flow levels for spawning (160, 200, 275, and 350 cfs), with spawning flows provided to Reach 4 from either the dam (flow down the Chelan River) or flow pumped from the tailrace to Reach 4. Reaches 1 and 2 were evaluated for cutthroat trout rearing and spawning habitat in the existing river channel. Reach 4 was evaluated for potential spawning and rearing habitat for chinook salmon and steelhead trout if the channel was mechanically altered to enhance the habitat potential above the capabilities of the existing channel.

Under these conditions, total rearing habitat for cutthroat trout ranged from 5.8 acres at 80 cfs base flow to 7.6 acres at 150 cfs, while spawning habitat changed from 0.49 acres at 80 cfs to 0.79 acres at 150 cfs. Increasing flows in the fall for salmon spawning in Reach 4 was shown to decrease rearing habitat for cutthroat trout in Reach 2, while not substantively improving rearing habitat in Reach 1. Water temperatures and food availability limits the suitability of the habitat for cutthroat trout, and may play a greater role than flow levels in Reaches 1 and 2 (Stillwater Sciences).

In Reach 4, Stillwater Sciences (2001) analyzed the potential of various trapezoidal channel widths (30, 40, 50, 60 and 70 feet) at the different rearing flows (80, 115, and 150 cfs) and spawning flows (160, 200, 275 and 350 cfs) using Manning's equation to assess average hydraulic conditions. Although the channel would not maintain its trapezoidal form, it will adjust itself to a stable condition once flows are added and the method is suitable for comparison of alternative widths and flows.

The Stillwater Sciences (2001) study recommended a stream channel configuration that would provide good spawning gravel and velocities for chinook salmon in some areas and somewhat steeper gradient boulder and riffle in others (section 3.1). Stillwater Sciences concluded that the overall gradient through Reach 4 would require the higher velocity, higher gradient sections in order to provide the more preferred conditions in the spawning area. The goals of increasing habitat diversity and sinuosity in Reach 4 also led to the recommendation that the reconfigured channel have different gradient sections. The higher gradient sections, including the uppermost 700 feet of Reach 4, will be too steep in gradient (0.011) to provide rearing or spawning habitat for chinook salmon, but will be within the preferred range for steelhead trout. The 400-foot segment of Reach 4 just above the backwater effect of the Rocky Reach reservoir was also too high in gradient (0.010) to provide optimal conditions chinook salmon spawning and rearing habitat (Stillwater Sciences). However, localized pockets of habitat in the lee of boulders or at the stream margins could develop as the stream stabilizes. For steelhead trout, the higher gradient sections of Reach 4 could provide rearing habitat with suitable velocity cover from large cobbles and boulders, with gravel patches also likely to be suitable for steelhead spawning.

In the middle 500-foot section of Reach 4, the lower gradient (0.0039) produced more moderate velocities. The velocity requirements for chinook salmon spawning could be met at some combination of flow for all channel widths except at 350 cfs. At 350 cfs, the channel width would need to be greater than 70 feet to reduce velocity. The relationship between channel width, velocity and depth at the different flows did not produce an ideal combination for the simple trapezoidal channel. There were no flow/channel width combinations that satisfied both depth and velocity criteria because velocities slow enough for spawning occurred at depths that were too shallow for spawning (Stillwater Sciences). However, results indicated that with inclusion of boulder placements, and as the channel stabilizes over time, water depth will vary somewhat and it is likely that there will be areas with adequate depth, velocities, and substrate for chinook salmon and steelhead spawning (Stillwater Sciences). For example, average velocities in this section of Reach 4 are too high for rearing emergent fry, but velocity cover behind boulders and in large cobble or other cover along the channel margin will provide rearing habitat for chinook salmon and steelhead trout.

Stillwater Sciences also evaluated the stability of spawning-sized gravels in Reach 4 using Shields stress analysis and a flow of 4,500 cfs, which is slightly higher than the 1.5-year recurrence flow. The analysis determined that the gravels will be stable at 4,500 cfs, but may need to be replaced following higher flows.

The lower 480 feet of Reach 4 is backwatered by the Columbia River and could not be modeled. This reach is low gradient with suitable substrate and at spawning flow levels will likely increase chinook and steelhead spawning habitat.

Stillwater Sciences concluded that adding suitable substrate to the Project tailrace upstream of the spawning habitat currently used by chinook salmon would be the most feasible, durable, and effective approach to increasing production of chinook salmon and steelhead in the Chelan River. It recommended that the tailrace modification have a varied morphology with alternate bars, rather than a uniform morphology and depth. This morphology would provide a range of velocities and depths and is the design most likely to increase spawning and rearing habitat for both chinook and steelhead. The water surface elevation at the tailrace would increase by less than one foot with a constructed channel.

2.6.5 Working Group Flow Proposal

The NSWG, using the fundamental recommendations made by Stillwater Sciences (2001), reached agreement and set forth a proposed flow level of 80 cfs for the bypassed reach of the Chelan River. In addition, the NSWG provided for an annual spring runoff flow to simulate a natural hydrograph in all but low flow years. The NSWG selected spawning flows of 320 cfs, to be provided by the flow coming through the Chelan River and supplemented by pumping from the tailrace.

The year-round minimum flow level is 80 cfs with a spring/early summer flow increase to mimic the natural hydrograph e.g., provide flushing flows. The spring/early summer flow increase is variable, depending on the level of winter snow deposition and runoff forecast. In dry years, when the runoff is predicted to be less than normal (within the 80% exceedance range of historical runoff volumes), then only the 80 cfs minimum flow would be released. In average

water years, when the runoff is predicted to be normal (within the 21% - 79% exceedance range or 60% of the years based on historical records), then a 200 cfs minimum flow would be released from May15 through July 15. The exact timing of the flow increases could change depending on climatic conditions (spring temperatures or rain) and biological evaluations. In wet years, when runoff is predicted to be greater than normal (within the 20% exceedance level), then a 320 cfs minimum flow would be released from mid-May through mid-July. Minimum flows greater than 80 cfs would be subject to the ramping schedule specified in section 3.2.

Table 7-3: Natural Sciences Working Group Chelan River Flow Proposal (Chelan PUD 2001a)

Reach	Dry year (cfs)	Average year (cfs)	Wet year (cfs)
1, 2 & 3[1]	80 all months	80 July 16-May 14	80 July 16-May 14
		May 14 ramp up to 200	May 14 Ramp up to 320
		200 May 15-July 15	320 May 15-July 15
		July 16- ramp down to 80	July 16- Ramp down to 80
4[2] Spawning flow	80 + 240 pumped March 15 to May 15 and Oct. 15 to Nov. 30	320 by combination of spill & pumping March 15 to May 15 and Oct. 15 to Nov. 30 Incubation flow, as needed	320 by combination of spill & pumping March 15 to May 15 and Oct. 15 to Nov. 30 Incubation flow, as needed

[1] Flows measured at the dam by calibrated gate rating.
[2] Flows measured at the dam or through calibrated pump discharge curves.

In addition to these minimum flows, the CRBEIP includes criteria to define wet, dry, and average water years (above); ramping rates necessary to prevent stranding of aquatic organisms (section 3.2; Table 7-6); criteria for physical modifications to the stream channel and tailrace (section 3); and a monitoring and evaluation program (section 4). Chapter 8 of the Comprehensive Plan includes criteria for lake level refill management to avoid excessive spill levels and scouring flows in the Chelan River.

The Parties determined that this instream flow regime would establish a functional aquatic ecosystem supportive of native fish species in Reaches 1 and 2, and provide enhanced conditions for salmon spawning and rearing in Reach 4. In addition, the 80 cfs instream flow level would provide these ecological benefits while preserving other beneficial uses. Anchor Environmental also measured total dissolved gas, pH, and total suspended solids in the Chelan River, and found these parameters to be within the range specified by Washington State's water quality standards.

2.7 Discussion of Temperature Relationships in the Chelan River

Under the existing license and Section 401 certification, there is no minimum flow required. The Chelan River is currently dry from the end of the spring spill, which does not occur in all years, through summer, winter, and until the next spring. During years with spill, the flows in the Chelan River have ranged from a few hundred cubic feet per second to over 10,000 cfs during years with high runoff volumes. Past practices under the current license have focused on refilling the lake quickly to reach elevation 1098 by July 1 for recreation purposes. Once the lake is at 1098, all flow excess to the hydraulic capacity of the turbines (2200 cfs) has been spilled. In years with very large snowpacks or delayed runoff conditions, spill has been initiated prior to the

lake reaching the 1098 fill level in order to limit the potential for bank erosion in the Chelan River channel. Spill flows are held to 8,000 cfs or less when feasible. Spillway flows have exceeded 9,000 cfs on 5 days since 1990, with all 5 of those days occurring in 1995. Spillway flows have occurred on 18 percent (832) of the days from January, 1990 through August, 2002 (4635 days).

Water from Lake Chelan enters the Project's influence at the Chelan Dam, located on the upper end of the Chelan River. The Chelan River has a natural shallow area near the outlet to Lake Chelan that controls the depth of water from the lake that enters the Chelan River. The penstock for the Project draws water from the Chelan River at a depth of 1068 (top of intake tunnel) to 1061 (bottom of tunnel).

2.7.1 Chelan River Thermodynamics – Site Potential

Lake Chelan water entering the Chelan River is naturally warm in the summer, generally exceeding the salmonid preference limit of 18°C from June through September. Water temperature information from 1994 – 2002 shows that the water temperatures in Lake Chelan increase substantially from May – August. The initial temperature coming in from the lake is generally below 18°C in May, and ranges from 15°C - 20°C in June, 17°C - >24°C in July, 20°C - >24°C in August, and 17°C - 23°C in September (Figures 7-2 to 7-6). Temperature data collected from cooling water intakes at the powerhouse (Figure 7-2, Figures 7-4 to 7-6) track the water temperature. The temperature measured at this location represents the temperature of water entering the penstock intake from upstream of the Project's influence since water does not change in temperature within the penstock. Independent temperature measurements from the USGS water quality database show that maximum temperatures in the Chelan River upstream from the Project's influence can exceed 25°C, and will exceed 23°C in most years at some point during summer (Figure 7-3). The water temperature in the upper section of the Chelan River, upstream from the spillway, is the result of natural warming in the relatively shallow Wapato Basin of Lake Chelan.

As water flows through the Chelan River above and below the spillway, the water will either warm or cool, depending on ambient weather conditions. Lower flows are more responsive to weather than higher flows, and maximum daily water temperatures are generally higher under lower flows. During the summer months, water warms as it passes through the upper Chelan River. The temperature model predicts some warming would occur, even during discharges of several thousand cubic feet per second. Thus, water temperatures in the Chelan River are subject to some daytime warming under natural inflow levels (Appendix A, Figure 27), as well as under flow levels provided in the CRBEIP.

At flows above 1,500 cfs, water temperature varies on a diurnal cycle by a moderate amount, ranging from a few tenths of a degree up to 0.5 degrees C under extreme climatic conditions (temperature model results, Appendix A). At lower flows, diurnal changes in temperature are greater, with the water heating during the day and cooling during the night. At 80 cfs, the temperature difference between daytime high and nighttime minimum ranges from 2 C - 5 C during hot weather from June through August. The aquatic community experiences a more or less constant temperature regime at high (above 1,500 cfs) flows, whereas at lower flows the temperature is significantly cooler at night and experiences a temperature spike in the afternoon.

Thus, at higher flows the river temperature would be near the temperature of the water exiting Lake Chelan throughout the 24-hour period, while at lower flows the water temperature would be significantly cooler at night and warmer during the afternoon. Water temperatures at lower flows would be significantly cooler than the temperature at higher flows in the fall (Figure 7-7) due to the cooling effect as air temperatures and solar radiation decrease.

The site potential for water temperature in the Chelan River is primarily determined by the initial temperature at the spillway and the configuration of the river channel. The daily mean temperature is primarily controlled by these factors, and is relatively consistent over a broad range of flows (4.2 in Appendix A). As previously noted, the Chelan River can never attain the salmonid preference limit of 18°C because the water coming from Lake Chelan exceeds this temperature by several degrees C for much of the summer and early fall. The degree of the daily heating and cooling cycle in response to climatic conditions and solar radiation can be manipulated to some extent through regulation of flows, limiting heating during June and July with higher flows while increasing cooling in late summer-fall by reducing flows (section 5 in Appendix A). However, other factors besides flow can influence temperature response. The main influence on heating is exposure to solar radiation. This is a function of the width/depth ratio of the river channel and shade. In addition, the biotic community, particularly fish, may find refuge from daytime temperature spikes if groundwater discharges are significant in relation to the total river flow. These factors are discussed below.

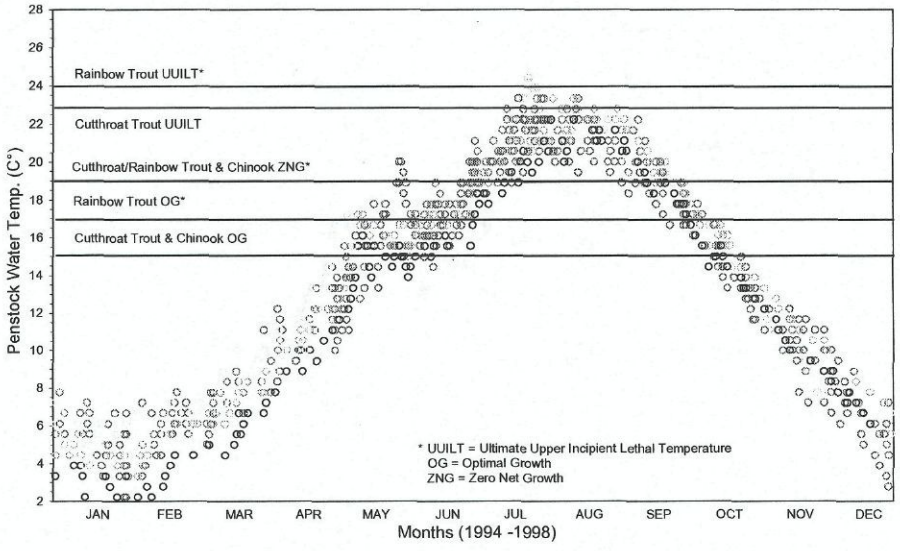

Figure 7-2: Water temperature measurements obtained at the Lake Chelan Hydroelectric Project powerhouse from 1994 through 1998 (R2 and IA 2000)

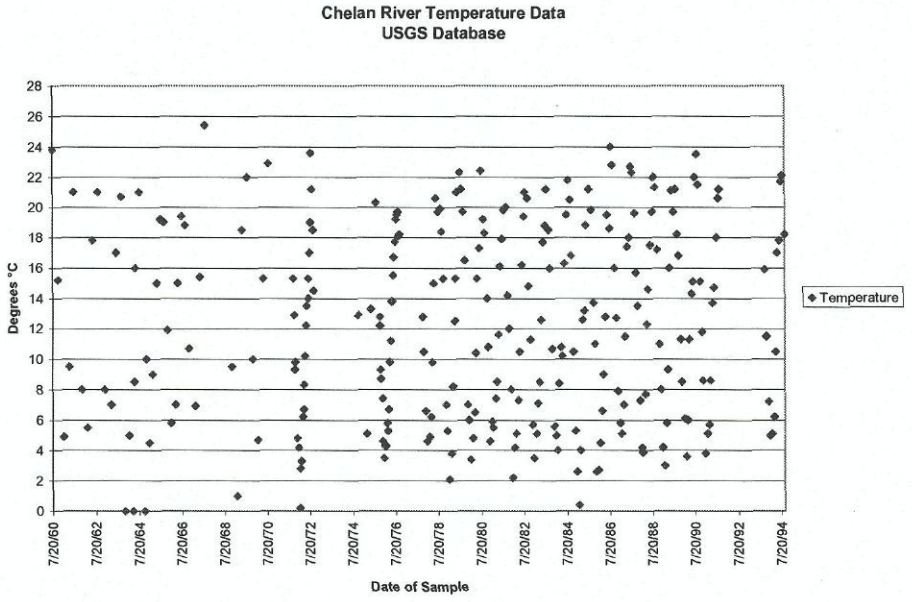

Figure 7-3: Water temperatures recorded in the Chelan River during monthly water quality sampling (USGS Database).

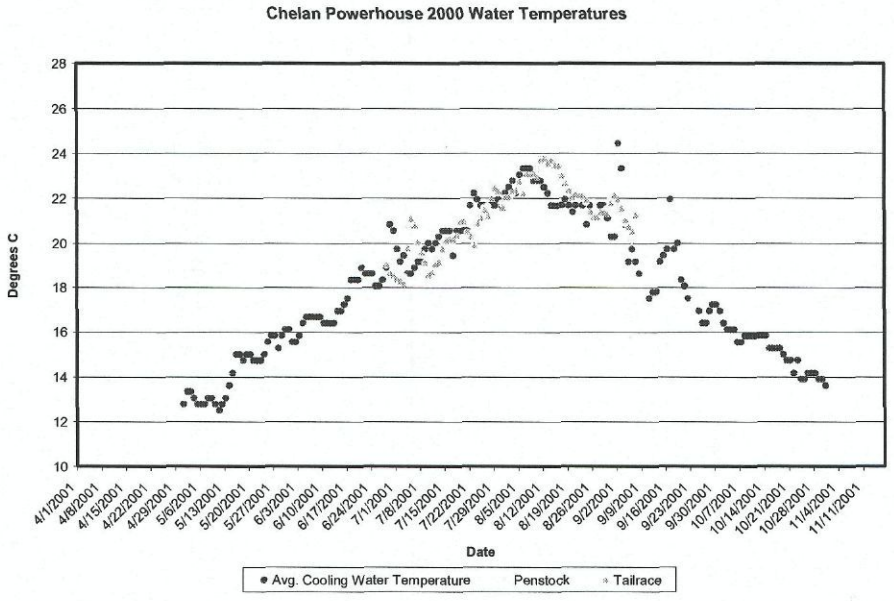

Figure 7-4: Water temperatures recorded in the Chelan River in 2000 (combination of measurements at the spillway and at the powerhouse)

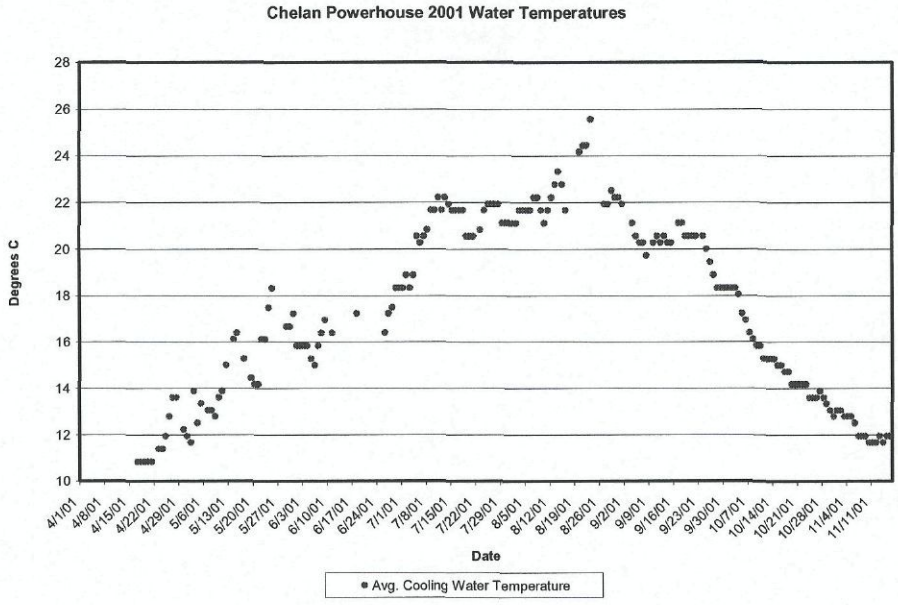

Figure 7-5: Water temperatures recorded in the Chelan River at the spillway in 2001 (as measured at the powerhouse).

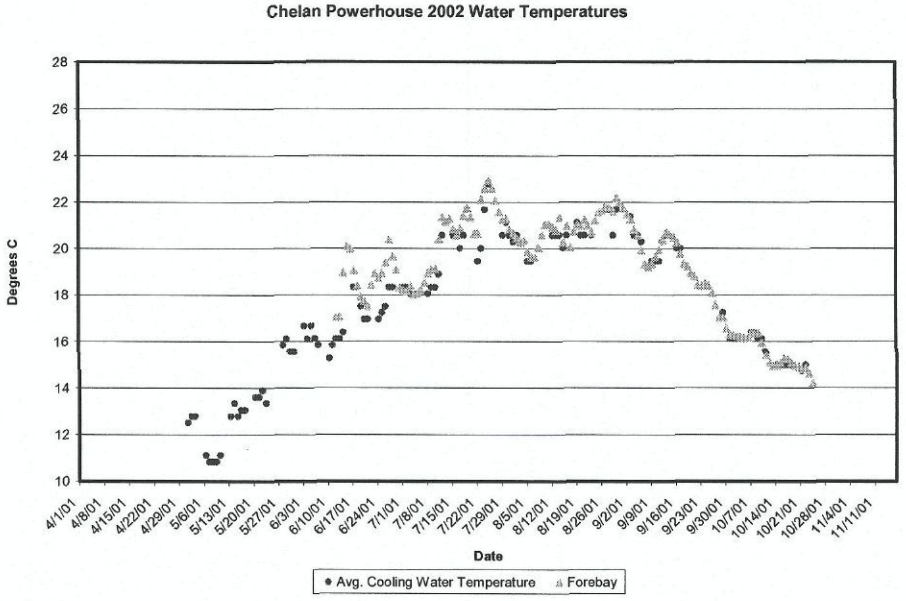

Figure 7-6: Water temperatures recorded in the Chelan River in 2002 (combination of measurements at the spillway and at the powerhouse).

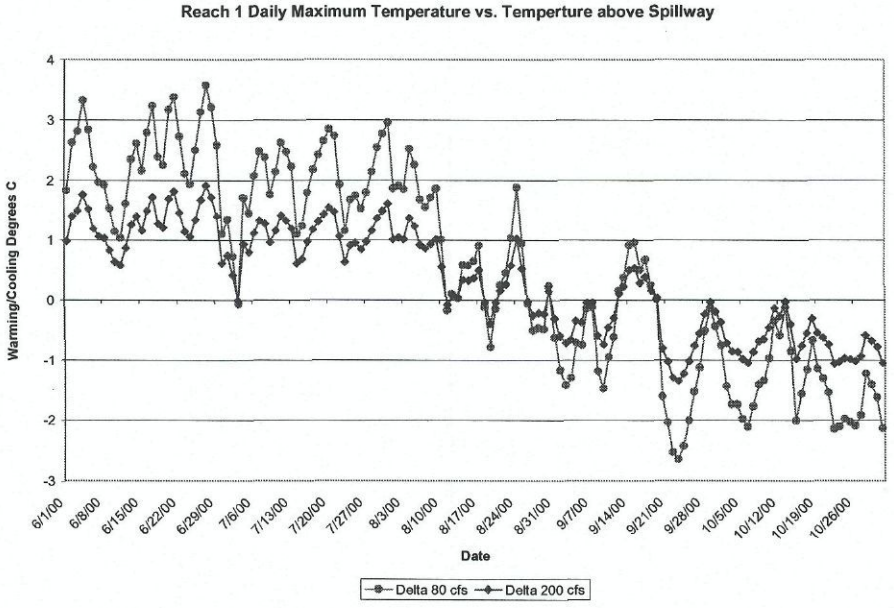

Figure 7-7: Predicted temperature response of daily maximum temperature of the Chelan River at flows of 80 cfs and 200 cfs.

Influence of Fluvial Process on Thermodynamics

The existing Chelan River channel has been formed by high flow events, on the order of 15,000 – 20,000 cfs. The channel in Reaches 1 and 2 is a relatively flat-bottomed U- shaped channel. For the past 75 years, the Chelan River has not experienced the continuous flows throughout the year that lead to definition of a low flow channel thalweg. Consequently, the current condition causes water at low flows to be spread across a broad area, particularly in the riffles and glides. The channel width/depth ratio will slowly decrease due to natural bed load movement once year-round minimum flows are established. The rate of low flow thalweg formation can be accelerated through use of hydraulic channel structures, boulder placement, and other established techniques. Also, the proximity of the low flow thalweg to steep, southern banks of the river channel can be increased through use of in-channel structures that direct the thalweg toward these sources of topographical shading. In Reach 4, the habitat enhancement channel reconfiguration proposed in the CRBEIP will greatly reduce the width-to-depth ratio in this section of the Chelan River, as compared to current conditions.

2.7.2 Other Major Influences

The Chelan River flows through a rocky, arid landscape that does not readily support riparian vegetation. Further, the extreme volatility in the annual hydrograph, with periodic floods exceeding 15,000 cfs, has scoured the soils from the stream margins. Shade from riparian vegetation will always be minor, which is a major contributing factor to the temperature response of the river in summer.

The Chelan River flows through a combination of glacial deposits and bedrock. Moraine and outwash remains from the glaciation of the area are found throughout Reach 1, while bedrock predominates in Reach 3. The glacial deposits in Reach 1, although somewhat consolidated and slightly cemented in many areas, are permeable in many areas, and sub-surface flow is observable in many locations in Reach 1 and Reach 2. After the cessation of spill, the river channel in the lower end of Reach 1 and in Reach 2 continues to have flows of 2-3 cfs for several weeks, and deep pools persist throughout the year in Reaches 2 and 3. At higher river flows, these sources of groundwater are immediately diluted by turbulence from the streamflow. However, at low flows the groundwater and sub-surface river flow may provide zones of cooler water where fish could find refuge during the daytime peak temperatures. Nighttime temperatures in the Chelan River will be cooler at low flows than at high flows. Thus, since the water temperature naturally occurring in the Chelan River from June through September is unfavorable for cold water species, the low flow combination of cooler nighttime water temperatures and groundwater refugia during the day could be advantageous for cutthroat trout in Reaches 1-3.

In Reach 4, the proposed reconfiguration of the river channel discussed in section 3.3 will reduce the heat load that comes from solar radiation. Daytime temperatures can also be moderated, if necessary, through use of the pumping station, which will have water from the penstock that has not been heated since being drawn from the upper Chelan River. In the late summer and fall, the greater cooling that will occur at lower flows will be beneficial to chinook salmon that are spawning in a declining temperature regime. The 80 cfs entering Reach 4 will be 1-2 degrees cooler than water coming from Lake Chelan in early October, when the water temperature at the

spillway can still be 16-18 degrees C. Chinook spawning success is greater when water temperatures are below 16°C.

2.7.3 Temperature Modeling

A thermodynamic stream temperature model, SNTEMP, was developed for the NSWG in order to evaluate temperatures that will occur in the Chelan River under different climatic conditions and at different flows. The SNTEMP model has been fully calibrated with empirical measurements collected in 2002. Predictions of Chelan River temperatures have been made for a variety of flows and climatic conditions. Simulations using ambient climatic conditions and initial water temperatures from 2000, 2001 and 2002 were also generated. The SNTEMP model could not be used to predict the temperatures for the proposed habitat modification in Reach 4 because the channel geometry has not been defined. Thus, predictions of temperatures in Reach 4 are based on water flowing through the existing channel, without modification. Similarly, the temperatures predicted for Reaches 1 and 2 are for the existing channel condition. A sensitivity analysis of channel width, to determine or estimate the potential value of channel modifications to improve temperature conditions was also evaluated (Chelan PUD 2002). A detailed analysis of potential water temperatures at different flow regimes is contained in Appendix A.

In summary, the SNTEMP model predicts that stream temperatures in the Chelan River increase in the daytime and cool at night in proportion to the difference between the ambient climatic conditions and the temperature of water arriving at the spillway. The greatest increases in daily maximum water temperature occur in Reach 1.

The temperature response of the Chelan River to lower or higher flows depends primarily on the initial temperature entering the river from Lake Chelan, the climatic conditions and flow. In general, the initial temperature coming from Lake Chelan is cooler than the daily average air temperature in June and early July, but tends to be warmer than the air temperature in August and September. Consequently, the Chelan River will tend to have increases in water temperature in early summer and water temperatures will tend to cool in late summer and fall. The quantity of flow in the Chelan River influences the amount of heating or cooling that occurs and the range of daily fluctuations in temperature.

During extremely warm climatic conditions, the temperature response in Reach 1 at high flows (1,500 cfs and above) is limited from a few tenths of a degree to 1/2 a degree centigrade above and below the temperature of water leaving the lake. The large water mass at high flows absorbs considerable heat without a corresponding temperature change and the water velocity carries the water mass past the areas in Reach 1 fast enough to limit exposure to solar radiation.

As flows decrease, daily fluctuations in temperature become more pronounced. The amount of daily temperature change at 600 cfs is roughly 0.3°C greater than at 1,500 cfs. At flows of 300 cfs, 200 cfs and 80 cfs, the temperature response predicted by the model for the highest recorded two weeks of extremely warm weather averaged 0.7°C, 1.0°C, and 2.2°C, respectively, at the end of Reach 1 (Figure 7-8).

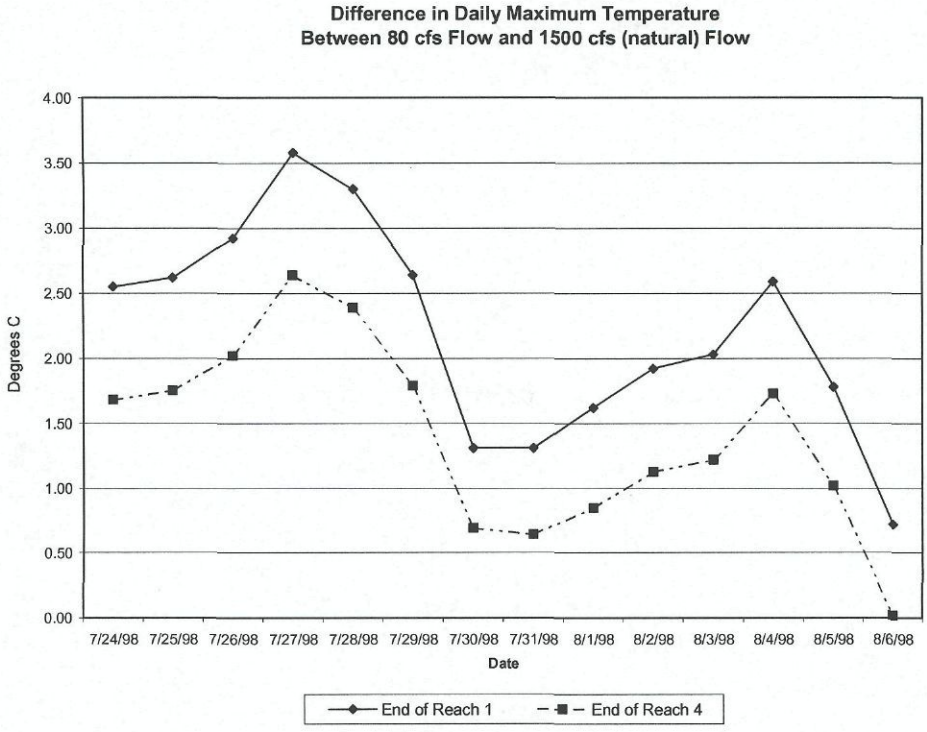

Figure 7-8: Temperature response in the Chelan River (during the warmest two-week period on record) at minimum flow of 80 cfs compared to a higher flow of 1,500 cfs, representing natural conditions (Chelan PUD 2002).

The effect of the proposed flow regime in the CRBEIP is to limit heating during the early summer by providing increased flow (200 cfs in average years, 320 cfs high flow years). In many years, there will be additional flow from the spillway in late June - July that will further reduce heating in the Chelan River during the month preceding and following the summer solstice. The summer solstice is the time of year when heating from solar radiation is greatest because azimuth of the sun is higher. The water entering the Chelan River is cooler in June and early July. Thus, although the potential for heating is high, the greater flows and cooler initial temperatures result in Chelan River water temperatures that are well within the tolerance range for cutthroat trout and cool water species.

In the late summer and fall, the 80 cfs minimum flow allows considerable cooling to take place in the Chelan River as the water temperature responds to cooler nighttime temperatures (Table 7-4). At this time of year the initial water temperature received from Lake Chelan is much warmer than the preferred temperatures of cutthroat trout. However, the 80 cfs minimum flow will result in significant cooling of water temperatures, beginning in the evening and continuing through mid-morning. This cooling effect provides several hours of water temperatures that are cooler than would be experienced with higher minimum flows. Water temperatures at the higher flows would remain near the initial temperature throughout the day.

Table 7-4: Monthly average of increase (°C) above initial temperature in daily mean water temperature at the end of Reach 1 of the Chelan River for 80 and 200 cfs releases (Chelan PUD 2002).

	2000		2001	
Month	**80 cfs**	**200 cfs**	**80 cfs**	**200 cfs**
June	0.99	0.56	0.66	0.39
July	0.56	0.34	0.46	0.29
August	-0.55	-0.23	-0.34	-0.13
September	-1.74	-0.84	-1.28	-0.61
October	-2.15	-1.04	-2.21	-1.07

The proposed flow regime for the Chelan River avoids heating when natural temperatures are cooler and promotes cooling when natural temperatures are warmest. The NSWG flow proposal provides higher flows in June and July when heating from solar radiation is at its greatest level, then takes advantage of the greater cooling potential of lower flows in August and September, when water temperatures coming from Lake Chelan are at their peak levels.

2.8 Review of Biological Objectives and Site Limitations

The biological objectives developed by the NSWG for the Chelan River include the following:

- Establish a functional aquatic ecosystem throughout the Chelan River
- Provide spawning and rearing habitat for chinook salmon in Reach 4 and the tailrace
- Provide spawning and rearing habitat for steelhead trout in Reach 4 and the tailrace
- Provide rearing habitat suitable for cutthroat trout and other native species in Reaches 1-3, consistent with natural site potential (natural water temperatures may be a limiting factor).

These biological objectives have a number of potential natural limiting factors that could influence the species diversity of benthic organisms, the success of cutthroat populations in the summer months, and the population size of the various fish species. An extensive list of the potential limiting factors has been presented in section 2 (Background). Those limiting factors that are related to the operations of the Project or are the focus of section 3 (Management Considerations and Options Considered) are specifically discussed here.

Water temperature is a significant, naturally occurring limiting factor for the objectives of establishing a functional aquatic ecosystem and for establishing cutthroat trout habitat in Reaches 1-3. The high water temperatures in summer are likely to limit the species diversity of benthic organisms and could prevent cutthroat trout from persisting or prospering in the summer. Ultimately, the initial water temperature coming from Lake Chelan will be the determining factor for species diversity of the benthic community, independent from the Project's operations, because the incoming temperature is the greatest determinant of daily mean temperature. Water temperatures exceed the temperature of zero net growth of cutthroat trout for over three months every year. The water temperature is also unfavorable for production of preferred cutthroat food organisms from the benthic community. In addition, the water temperature entering the Chelan River is known to exceed the ultimate upper incipient lethal temperature for cutthroat in a significant number of years (Figure 7-2 and Figure 7-3).

The natural landscape, which is arid, rocky and erosional, prevents establishment of significant riparian vegetation. The Project's use of storage capacity and spill management will greatly decrease the erosion and bedload instability that is the natural condition for the Chelan River. However, the flood-scoured river channel, poor soils and arid climate will likely prevent the establishment of a significant riparian plant community. The lack of a riparian corridor, with resultant leaf litter and other organic input to the river will further limit the species diversity and density of the benthic community.

The reconfiguration of Reach 4 of the Chelan River will likely provide good spawning habitat and fry rearing habitat for steelhead, but the Chelan River is not likely to produce steelhead smolts. Steelhead in the mid-Columbia River watersheds typically rear for 2-4 years in freshwater prior to smoltification and migration to the ocean. In their final year prior to smoltification, these fish are commonly over 6 inches in length. They require swift water habitats with deep pools, runs and riffles. Reach 4 is too short to provide habitat for a large population of steelhead pre-smolts and the summer water temperature regime is also unfavorable for their growth and survival. Steelhead production will likely be dependent on emigration of parr to the Columbia River for rearing to smolt size. Rearing habitat for emergent fry will be available in Reach 4 and success may be achieved if the fry can attain sufficient size to escape predators prior to migrating to the Columbia River.

Chinook salmon have been spawning in the Chelan tailrace for over two decades. Although success of this spawning is unknown, a spawning population has been evident every year since the 1980s. The fry currently migrate to the Columbia River within a short time after emergence. The survival rate of these fish is unknown, but the spawning population is increasing (although tag recoveries indicate that a high proportion of the spawning population is from returning hatchery fish). The proposed actions should increase both spawning habitat area and provide rearing habitat for newly emerged fry. The limited benthic food sources, particularly in the tailrace, may be the main limiting factor for rearing chinook fry.

SECTION 3: MANAGEMENT CONSIDERATIONS AND OPTIONS INVESTIGATED

3.1 Habitat and Flow Options Considered

As stated previously in section 2.6.1, the IFIM analysis for Reaches 1 and 2 demonstrated, in general, that habitat availability in the upper reaches of the Chelan River was greatest at flows between 60 cfs and 240 cfs for cutthroat trout and suckers and that the total combined useable habitat area in Reaches 1 and 2 for both cutthroat and suckers was optimized at flows in the range of 80 cfs – 160 cfs, 95-100 percent of maximum.

Habitat area evaluations for Reach 4 included additional species, chinook salmon and steelhead. The key consideration for these species was the relationship between flow and spawning habitat. Spawning habitat in Reach 4 is primarily limited by lack of suitable substrate, regardless of flow. In the existing channel, a flow of 650 cfs provided the highest estimated useable area. However, a number of options for channel modification in both Reach 4 and the Project's tailrace offered more promise for enhancement of chinook salmon and steelhead trout spawning habitat than could be obtained by providing the 650 cfs flow to the existing channel. The NSWG selected an independent consultant (Stillwater Sciences) with expertise in fluvial geomorphology to evaluate a number of alternatives to provide habitat for spawning and rearing of chinook salmon and steelhead trout in both Reach 4 and the tailrace. The development of concepts and subsequent evaluations was done interactively between Stillwater Sciences and the NSWG.

The existing river channel in Reach 4 and the tailrace both currently lack habitat diversity necessary to support rearing of juvenile salmonids and other functions of a natural aquatic ecosystem. The CRBEIP includes habitat modifications to the river channel in Reach 4 and the tailrace. Reach 4 currently has little sinuosity and no large boulders or structure to create gravel catchments, scour pools and other habitat features. The CRBEIP proposes to use standard river habitat restoration techniques to accomplish the goals of providing and maintaining gravel areas for spawning, boulder placements for cover and pool formation, and increased sinuosity to moderate velocities and provide additional area and habitat diversity. Habitat modifications to Reach 4 are shown conceptually in Figure 7-9. Most of the modifications proposed in Reach 4 will be done by a bulldozer. The following are specific modifications proposed for Reach 4 sub-reaches identified in Figure 7-9:

3.1.1 Sub-reach 4.1

1. Create narrower/steeper channel
2. Use large boulder placement
3. Move channel away from road
4. Add/move gravel to channel

3.1.2 Sub-reach 4.2

1. Create wider (100' avg.)/flatter channel
2. Use large boulder placement
3. Add sinuosity of ~1.2
4. Move channel away from road

5. Add/move gravel to channel

3.1.3 Sub-reach 4.3

1. Continue 100' channel width
2. Use large boulder placement
3. Add sinuosity of ~1.2
4. Add/move gravel to channel

3.1.4 Sub-reach 4.4

1. Continue 100' channel width
2. Use large boulder placement
3. Add sinuosity of ~1.2
4. Add/move gravel to channel
5. Align the downstream end of Reach 4 to provide constant flow across accessible spawning gravel in the confluence area to prevent redd dewatering during changes in river and powerhouse discharges.

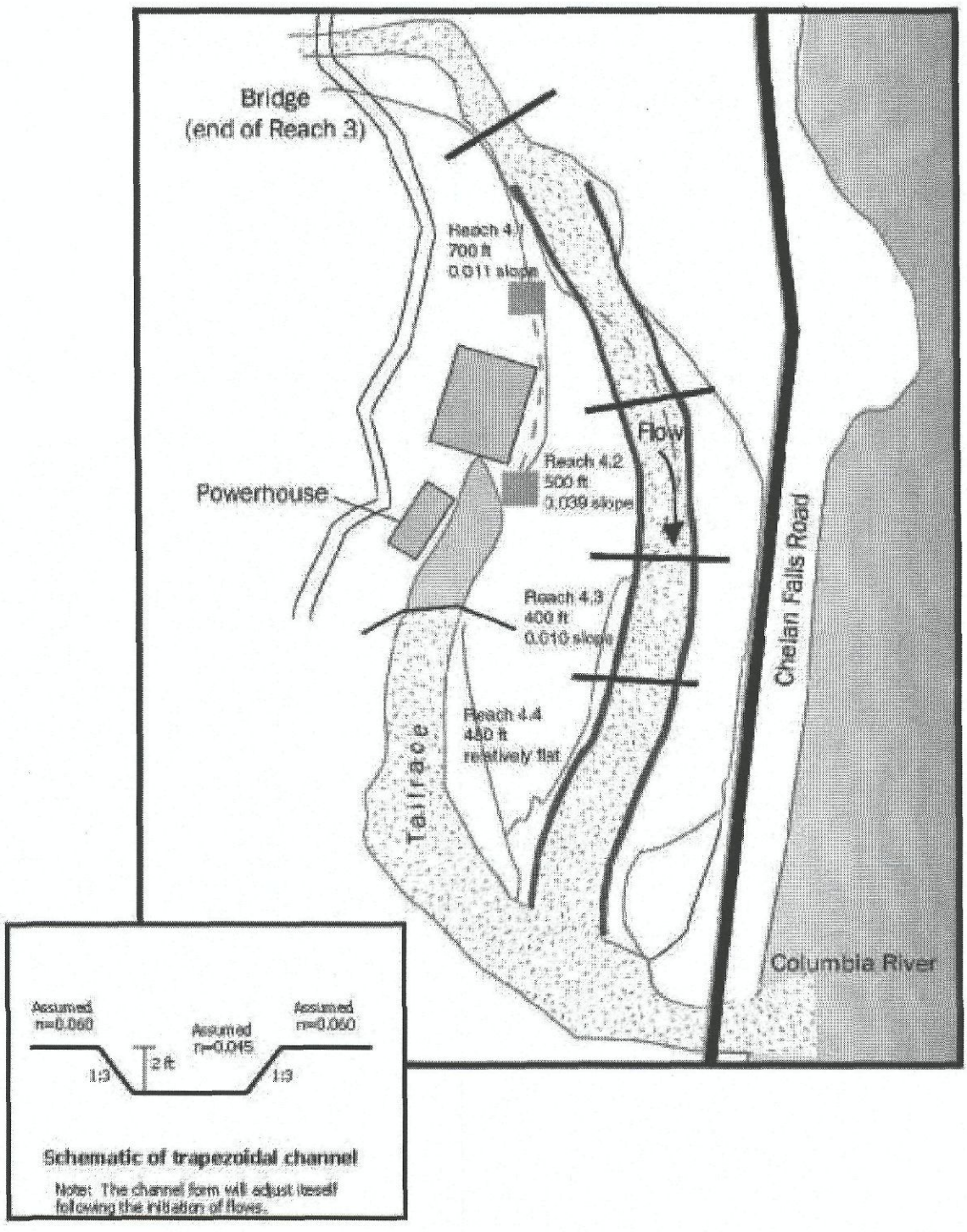

Figure 7-9: Schematic diagram of the subreaches of Reach 4, including an example of the trapezoidal channel

3.2 Habitat Modifications in the Tailrace

The tailrace area upstream from the confluence with the bypassed reach of the Chelan River, will be modified with suitable sized substrate material to create braided bars with low velocity rearing and spawning habitat. This proposed modification is shown conceptually in Figure 7-10.

Maintenance of suitable spawning flows and adequate intra-gravel flow for incubation in the tailrace, if needed, will be maintained through operation of the powerhouse at minimum flow levels or through water pumped into the spawning gravel through perforated pipe laid into the tailrace streambed. The success of spawning and incubation through emergence will be addressed through the monitoring and evaluation program (see section 5).

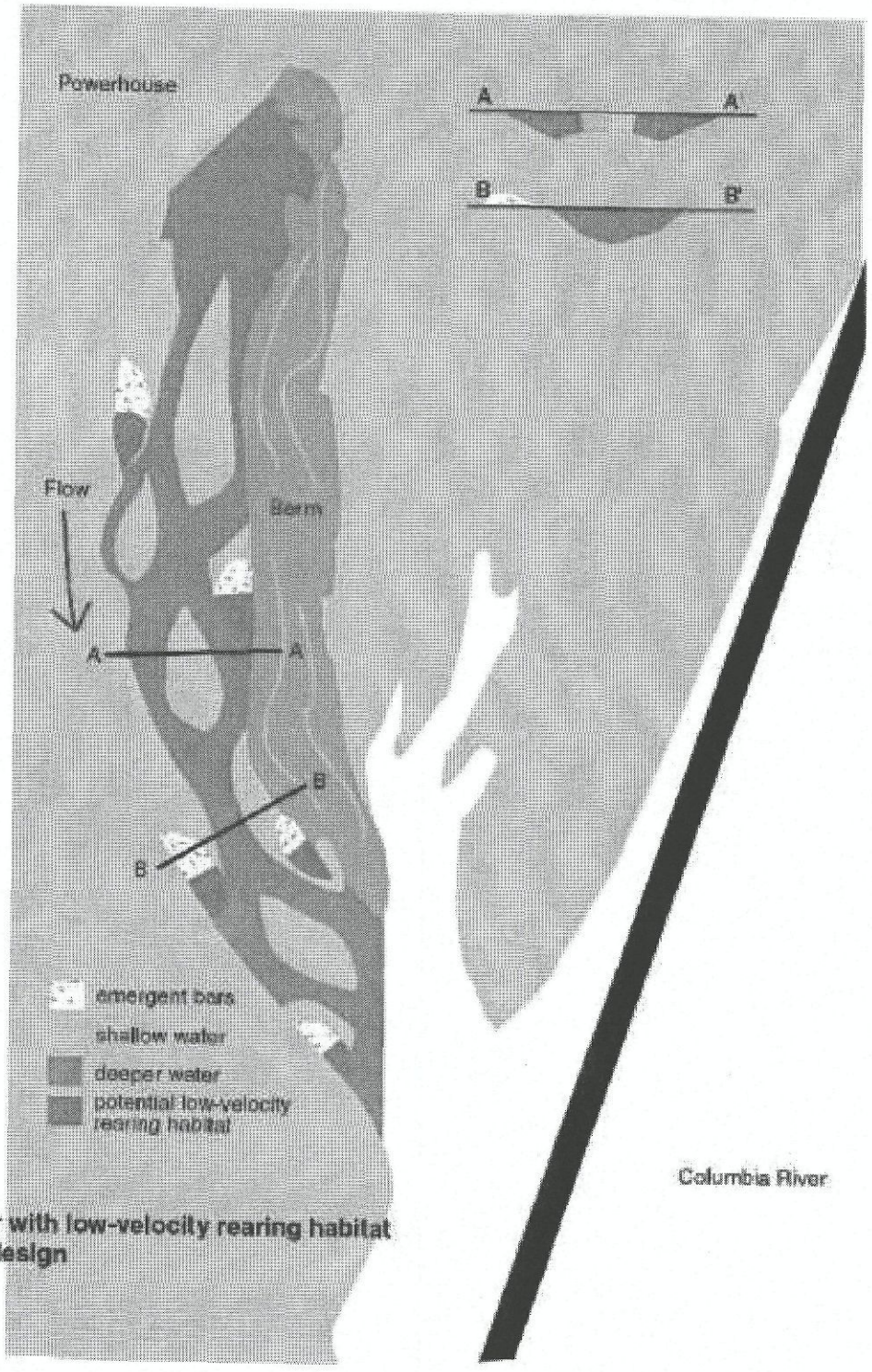

Figure 7-10: Braid bar emphasizing spawning and rearing habitat in the modified tailrace

The minimum flow of 80 cfs through Reaches 1, 2 and 3 provides a balance between optimal habitat for native cool-water species (suckers and minnows), while providing adequate habitat availability for cutthroat trout (Table 7-5). Based on the instream flow studies and habitat utilization curves (IA and R2, 2000), the 80 cfs minimum flow in Reaches 1-3 provides 6.75 acres of adult cutthroat habitat (76% of maximum), 2.18 acres of sucker spawning habitat (80% of maximum) and 9.12 acres of adult sucker habitat (100 % of maximum). The 80 cfs flow is also sufficient to provide continuity between the reaches and promote establishment of riparian vegetation and a streambed benthic community. The plan to provide a spring period of higher flows in 80 percent of the years is also intended to restore natural aquatic ecosystem functions that are related to annual variations in the hydrograph. The higher flows will increase soil moisture during the spring growing season when riparian species are adapted to spread and multiply. In years when spill would not occur or comes too late to match the requirements of riparian species, the spring flow releases will ensure habitat continuity and provide for downstream movement of plant material and other food resources.

Table 7-5: Rearing habitat (acres) for adult or juvenile fish under different flow recommendations (Source: R2 and IA, 2000)

Species	Flow Proposal					
	Working Group Proposal[1]		Initial Agency Proposal[2]		Initial Chelan PUD Proposal[3]	
	Reaches 1,2 &3	Reach 4	Reaches 1,2 &3	Reach 4	Reaches 1,2&3	Reach[4] 4
Smallmouth	11.0	2.0-3.0	6.6-5.9	0.8-0.5	10.1	3.8
Sucker	9.1	2.0-3.0	5.3-4.7	0.8-0.7	7.8	3.8
Rainbow	7.9	2.0-3.0	12.2-11.1	1.6-1.4	4.9	3.8
Cutthroat	6.8	2.0-3.0	8.0-7.4	1.0-0.8	4.3	3.8
Chinook Juvenile		2.0-3.0		1.4-1.0		3.8
Steelhead Juvenile		2.0-3.0		1.7-1.6		3.8

[1] Habitat area at flows of 80 cfs guaranteed.
[2] Natural habitat area at flows of 400 cfs and 650 cfs.
[3] Flow during growth season (March 15 – November) of 40 cfs.
[4] Assumes total wetted area of the enhanced stream is usable rearing habitat.

In order to protect aquatic organisms from rapid fluctuations in water levels, ramping rates are generally established to allow fish to move into and out of shallow zones without being stranded when flows decrease. During the period when fry may be present, ramping rates will be set at approximately 2 inches per hour, until biological evaluations have determined the ramping rates necessary to prevent stranding of fish in the Chelan River. Water elevations at various flows and locations were recorded during the instream flow studies in the bypassed reach of the Chelan River (Bypass Reach (Gorge) Flow Releases Study – R2 and IA, 2000). As shown in Table 7-6, in Reaches 1 and 2, a flow increase of 179 cfs from the base minimum flow of 80 cfs changed the average water elevation in the channel by .69 feet (8 inches). In Reach 4, a change in flow of 422 cfs raised the water elevation by slightly more than one foot.

Ramping rates do not apply when the hydraulic capacity of the Project has been exceeded by natural inflows and the lake is within one foot of being full (elevation 1099 feet).

Table 7-6: Natural Sciences Working Group Ramping Rate Proposal

Reach 1		Reach 2		Reach 4	
Discharge (cfs)	Water Elevation (feet)	Discharge (cfs)	Water Elevation (feet)	Discharge (cfs)	Water Elevation (feet)
81	88.04	81	91.12	117	87.87
260	88.73	260	92.09	539	88.93
Difference	0.69	Difference	0.98	Difference	1.06

The approximately 8 – 12 inch difference in average water elevation measured closely approximates the changes that will actually occur in the bypassed reach of the Chelan River with the proposed minimum flows (e.g. 320 cfs to 80 cfs). Ramping flows down to minimum flow levels shall be done gradually over a period of a few hours, which will be adequate to prevent water elevations from increasing or decreasing by more than 2 inches per hour in the bypassed reach of the Chelan River. The effect of flow changes and appropriate ramping rates will be developed during the monitoring and evaluation period in the CRBEIP.

3.3 Water Temperature - Options Considered

The NSWG considered the impact of the various minimum flows on water temperatures in four main areas. As previously discussed, the relationship between initial temperatures, climatic conditions and minimum flows on water temperatures in Reaches 1 - 3 were balanced with the other physical aspects of fish habitat (velocity, depth, cover and substrate). The NSWG solicited the development of a model to explore these relationships and develop options that could improve the temperature regime without sacrificing the other habitat characteristics provided by specific flow levels. In Reach 4, the development of a pumping station, coupled with significant stream channel modification provides additional options for temperature management. The current temperature regime of the powerhouse discharge replicates the initial water temperatures coming from Lake Chelan, with no additional warming beyond naturally occurring warm water conditions. The final consideration was the effect of the flow regime on the thermal load to the receiving water, the Columbia River. The fact that water passing through the penstock does not warm is a key factor in the options available for temperature management of the habitat that will be provided in Reach 4. The temperature regime of the Project under the existing license has not been discussed previously. Therefore, that discussion begins below, with the additional options considered for temperature management in Reach 4 and Reaches 1-3 to follow.

3.3.1 Temperature Effects of Powerhouse Diversion

The diversion of water through the penstock provides water temperatures in the tailrace and below the confluence that are cooler in summer than would be water coming from the Chelan River under natural flows. This is because water passing through the Chelan River bypassed reach absorbs thermal energy from solar radiation and exposure to warm air temperatures, while water used for hydroelectric generation at the Project is not subjected to thermal loading. Overall, mixed flows from the bypassed reach and the powerhouse tailrace are below the temperature that would occur with natural flows during the summer (Anchor Environmental

2000; Chelan PUD 2002). Fish that spawn and rear in the tailrace and below the confluence during the summer have a cooler temperature regime than would be the case if there were no discharge from the powerhouse. These lower temperatures will thus benefit salmon and steelhead in Reach 4 by providing a thermal refuge from warmer water that comes from the Chelan River during hot weather in summer.

The receiving waterbody, the Columbia River, is known to exceed the preference zone for migrating salmon and steelhead during the months of July - September. The EPA is proceeding with a TMDL for water temperature control on the Columbia River, with the stated goal of lowering water temperatures by reducing the thermal load to the river. The thermal loading to the Columbia River in the June through August period will be lower with the NSWG flow proposal than would occur under natural, pre-Project conditions. The lower thermal load is a result of the reduced mass of heated water coming from the bypassed reach of the Chelan River. Water at any flow level would receive additional thermal loading while passing through the Chelan River during the months of June – mid-August, and this thermal load is carried to the Columbia River. The larger the mass of water passing through the Chelan River, the greater amount of thermal energy that will be absorbed from solar radiation and exposure to warm air temperatures. Since the water used for hydroelectric generation is shielded from thermal loading, the mixture of water entering the Columbia River will only carry the thermal energy received from Lake Chelan and the additional thermal energy from the portion of flow that passed through the bypassed reach. Thus, minimizing the amount of flow passing through the bypassed reach and picking up heat energy will also minimize the thermal load delivered to the Columbia River.

Thermal loading to the Columbia River under natural flow conditions in the Chelan River would add a significant amount of heat during the hot periods in summer. This is illustrated by comparing the total heat energy that would be retained by water passing through the bypassed reach under different flow levels. Even though the increase in temperature experienced by higher flows is smaller than for lower flows, the total heat contained within the much greater mass of water at natural flow levels is nearly five times greater than the heat energy carried to the Columbia River at the 80 cfs instream flow proposed by the NSWG (Figure 7-11).

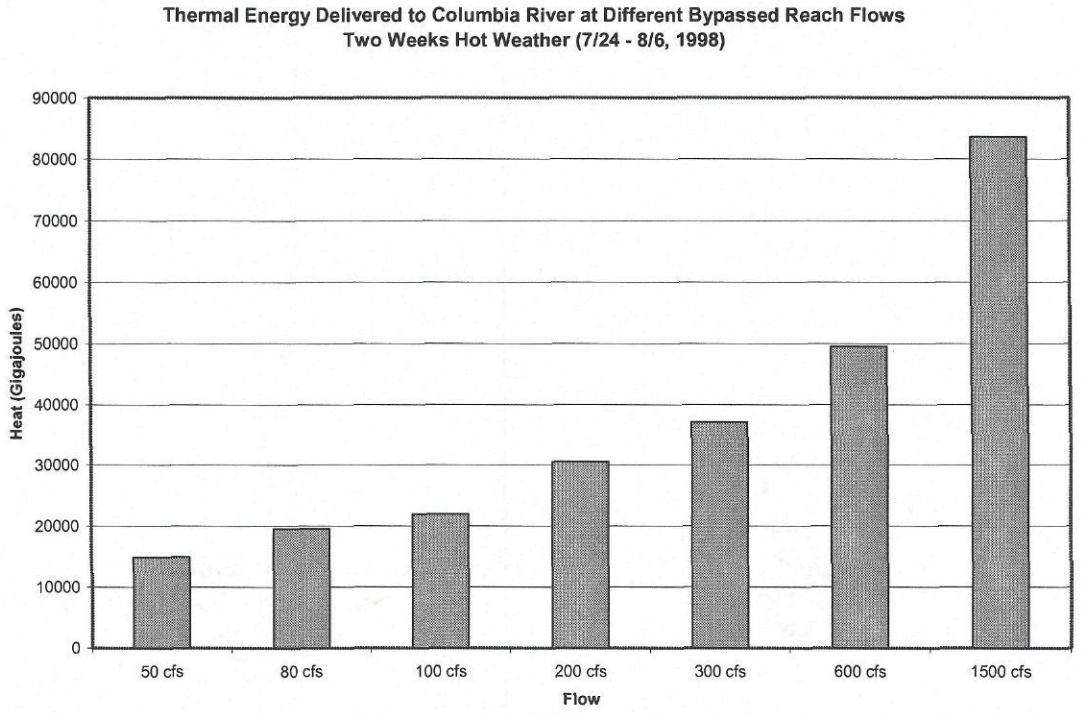

Figure 7-11: Thermal energy delivered to the Columbia River at different minimum flows to the Chelan River

3.3.2 Stream Channel Modification - Thalweg Formation

Temperature will increase in the Chelan River, regardless of flow level, when the river channel is broad and shallow. Since a main objective of the CRBEIP is to construct a new stream channel in Reach 4 for the purposes of enhancing spawning and rearing habitat for chinook salmon and steelhead trout, the width of the new channel will be different than the existing channel. In Reach 1 there are sections of the channel that are very broad and shallow. There is potential to use instream hydraulic modifications to reduce the channel width and increase depth and velocity at the minimum flow levels in this reach. The SNTEMP model was reset with a 50 percent reduction in channel width in Reaches 1 and 4 and the effect of the different channel width on water temperature was predicted, using the warmest day of the 1998 period previously modeled. The predicted temperature increases were much less than with the existing channel width (Figure 7-12). A 50 percent reduction in the width/depth ratio is equivalent to approximately a 1.0°C reduction in daily maximum temperatures on a hot day (air temp >30°C)(Chelan PUD 2002).

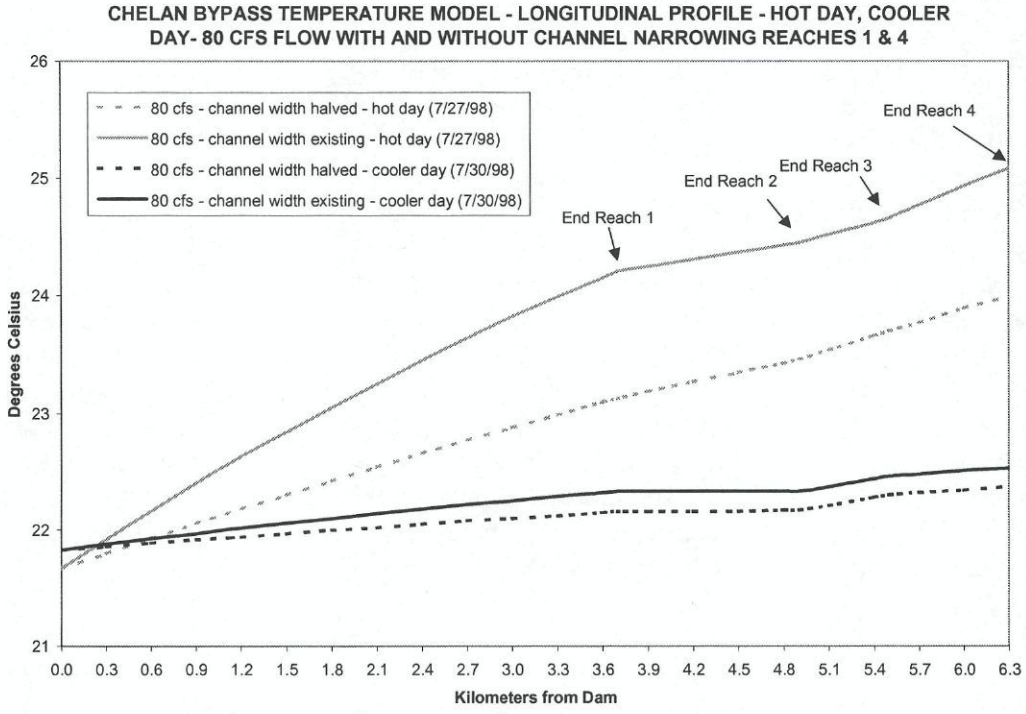

Figure 7-12: Sensitivity analysis of daily mean temperatures in the Chelan River with changed channel morphology in Reaches 1 and 4.

The existing river channel in Reach 4 and the tailrace both currently lack habitat diversity necessary to support rearing of juveniles and other functions of a natural aquatic ecosystem. The NSWG proposal included recommended morphological modifications to the river channels in both Reach 4 and the tailrace. Reach 4 currently has little sinuosity and no large boulders or structure to create gravel catchments, scour pools and other habitat features. The NSWG proposed to use standard river habitat restoration techniques to accomplish the goals of providing and maintaining gravel areas for spawning, boulder placements for cover and pool formation, and increased sinuosity to moderate velocities and provide additional area and habitat diversity. This stream channel work will also reduce temperature response below the existing channel in Reach 4.

Alternatives for temperature control in Reaches 1-3 include actions that would reduce the thermal load delivered to the Chelan River (deep water withdrawal at the dam rather than over spillway crest, reduce width/depth, move channel to maximize topographic shade, add riparian enhancement). These actions would be in effect at all times during minimum flows. Additional actions, such as daytime flow increases, cool water discharge from lake, ground water flow augmentation (pumping from wells) could be used, subject to feasibility, when necessary to prevent daily maximum temperatures from exceeding 24°C, which could be lethal to cold water species. These actions are discussed below.

3.3.3 Minimum Flow Diversion Structure

Currently, water can be released from the Project spillway between elevation 1100 ft. and 1087 ft., which is the elevation of the top of the spillway ogee. Water then spreads across the entire spillway apron before entering the Chelan River. A new flow diversion structure will be constructed at the Project in order to provide minimum flow releases at all lake elevations. The new diversion structure will ensure that minimum flows and augmented flows for Reach 4 can be released from the dam for emergency purposes in case of pump failure in the tailrace.

The diversion structure will tap off the existing penstock and release water in the Chelan River below the existing stilling basin apron. The diversion structure will be capable of releasing up to 320 cfs, the maximum flow that may be provided to Reach 4 in wet years for salmon and steelhead spawning. Temperature studies indicate substantial warming of water can occur as it passes over the apron due to shallow depth and large surface area. Temperature increases of 0.2°C were observed between the forebay of the spillway and a thermograph placed below the spillway apron. The new diversion structure will eliminate warming of water as it passes over the apron and, in addition, about 200 feet of broad, shallow river channel below the apron will be bypassed with a deeper and narrower channel.

3.3.4 Site Potential Shade

The Chelan River is a broad, U-shaped valley through much of Reach 1. However, due to the highly erosional characteristics of the river bed, there are a number of locations where the river channel has created steep banks exceeding 20 feet in height. These locations provide substantial shade, except at dates near the vernal solstice in June and July. The amount of profile shade can be increased in association with the thalweg formation process. Instream hydraulic structures and large boulder placement along some of these southern river banks could be used to encourage the thalweg to migrate close to the cliff-like topography, thus increasing the amount of shade provided by these landscape features.

The Chelan River currently has little riparian vegetation. Historical photographs demonstrate that this was always the case. The arid environment and soils in the area prevent the establishment of vegetation, and the high flow conditions in the past have also scoured riparian vegetation from most of the shoreline. Riparian shade could be increased by a limited amount where the river is near a south bank with insufficient height for topographic shade. Shade will have a greater effect in late July and August, when the azimuth of the sun's position is lower on the horizon. In order to accomplish the establishment of cottonwood and other trees with sufficient height to provide significant quantities of shade will require irrigation and protection from erosion. There are some locations in Reach 1 where this could be accomplished, in combination with hydraulic structures to encourage thalweg formation.

In Reach 4, opportunities may exist to increase shade in locations protected from high flow scouring by pulling together appropriate sized toe rock, woody debris and soils to create vegetated zones of stabilized banks for shade and food supply for aquatic organisms. The model can be used to evaluate the potential improvement in water temperatures that could be gained with riparian enhancement through bank projects and gravity irrigation from the Chelan River.

3.3.5 Cutthroat Habitat and Potential Thermal Refugia in Reaches 1-3

The NSWG recognized that cutthroat trout and other salmonid species are noted for their ability to seek out thermally buffered areas of streams and rivers where ground water flows into the river through the bank or riverbed. A small amount of ground water seeps sustain a number of deep pools and flow in Reaches 2 and 3 of the bypassed reach of the Chelan River, even when no surface flow from Lake Chelan has been provided for months. The temperature of this ground water is expected to be about 12°C, based on the temperature of other groundwater sources in the general area. These seeps could provide thermal refuge for cutthroat trout during the periods in July and August when daily maximum temperature is approaching lethal levels.

The low quantity of groundwater flow will not be able to form thermal buffers in conditions with turbulent mixing, thus at high flows it is unlikely that fish would benefit from thermal refugia. At the NSWG proposed 80 cfs flow level, however, the warmer water flowing through the river channel may glide past pockets of cool groundwater collected in the bottom of the pools without flushing it out. The studies planned for implementation through the CRBEIP will further determine if there are refugia and if cutthroat trout find and use such areas to offset the adverse temperatures in the summer months.

Under the CRBEIP, a monitoring and evaluation program will be implemented to determine the presence of cutthroat trout and other fish species and the production of benthic and other food organisms. Chelan PUD will evaluate the success of the CRBEIP in meeting the biological objectives and will report results to the Chelan River Fishery Forum (CRFF). Chelan PUD will make recommendations for implementation of optional components of the CRBEIP or other actions, if necessary, to support achieving the biological objectives. Chelan PUD will provide the CRFF with a draft of such reports and will consult with CRFF members prior to issuing final reports. The intent is for Chelan PUD and the CRFF to reach consensus regarding the evaluation and recommendations. If a CRFF member is not in agreement with the draft report or recommendations and has an alternative evaluation or recommendation, Chelan PUD shall include a discussion of that alternative evaluation or recommendation in the final report. Recommended actions to improve support of cutthroat trout within the seasons of use may include channel modifications, flow management and enhancement of thermal refugia.

3.3.6 Pumping of Tailrace Water into Reach 4

Tailwater

The CRBEIP includes the provision of additional flow into Reach 4 during the steelhead and late-run chinook spawning period to provide greater depths and velocities that will improve spawning habitat conditions for these species. The CRBEIP proposes to supply the additional flow by pumping from the tailrace, rather than providing this flow from lake storage (Table 7-3). The flow proposed in the CRBEIP is 320 cfs total, of which up to 240 cfs would be provided by pumps. Releases of 320 cfs from storage at the dam would reduce habitat availability for some species in Reaches 1 and 2 and would have adverse effects on lake levels and/or power generation. The additional pumped flow would be released into Reach 4 just upstream of the existing substation. The discharge location would be protected from damage during high flow periods. Spawning flows would provide optimal spawning potential in Reach 4. Depending on the location of redds that may be created by spawning salmon or steelhead in Reach 4, the pumps

may also be used to prevent dewatering of redds during incubation. However, the NSWG anticipated that the 80 cfs guaranteed minimum flow will be adequate for incubation in most cases, and the pumps would only be used for redd protection on an as-needed basis. Should pump failure occur during spawning activity or when needed for protection of incubating redds, the water supply will be maintained by providing the needed flow from a backup pump or from lake storage until the pump system is returned to service.

The design of this pumping station and discharge facility has been evaluated in a feasibility analysis, including an intake structure that meets state and federal fish screen requirements. The cost estimate for this pump station is $2,500,000. Annual operating costs for this option are estimated to be $15,000 for operation and maintenance and $5,000 for energy costs. The design for the tailrace would take advantage of the relative freedom from debris.

This pumping station may be used, if needed, to manage temperatures in Reach 4 during the rearing period of juvenile salmon and steelhead. Water temperatures in the tailrace are no warmer than the water temperature at the dam, thus during hot periods in the summer the addition of water from the pumping station could be used to reduce temperatures during the day and evening. Use of the full 240 cfs of pump flow could reduce water temperature in Reach 4 by up to 2.5°C at times when water temperatures entering Reach 4 are high due to heating within Reaches 1-3. For example, if water entering Reach 4 is 24°C and the tailrace is 21°C, the resulting Reach 4 temperature with pumped flow would be 21.25°C. This level of temperature reduction could be used to prevent temperatures in Reach 4 from exceeding critical levels, such as the ultimate upper incipient lethal temperature (UUILT).

Pumping from Columbia River - Feasibility Analysis

The temperature of water in the Project's tailrace is warmer than water in the Columbia River during the summer. Additional temperature moderation in Reach 4 could be obtained if the pumping station were located on the Columbia River. However, in the fall, when chinook salmon are spawning in Reach 4 and the tailrace, the water temperature in the tailrace is lower than the Columbia River. Water temperature cools rapidly in Lake Chelan in October, dropping below 16°C during the first week in October. The water temperature in the Columbia River is 19°C-20°C during this same period, when chinook spawning is initiated in the Chelan River. Thus, the potential benefit to juvenile rearing conditions in July and August would be offset by higher temperatures during chinook spawning. Also, the feasibility of locating the pumping station on the Columbia River is questionable. The issues of water rights, increased debris loading on the fish screens, biological concerns about mixing of water sources and the need to cross a highway and railroad line with the pipe, all contribute to the complexity of this option.

3.3.7 Increase Flow During Daytime

The naturally occurring peak summer water temperatures entering the Chelan River provide the basis for setting a threshold requirement for temperature management. In every year modeled (2000-2002), the temperature model predicted that the Chelan River would experience daily average and daily maximum temperatures surpassing 23.0°C (daily mean) and 24.0°C (daily maximum) in the bypassed reach under natural flow conditions. In 2000, the temperature of the Chelan River under natural flows was predicted by the model to exceed 25.0°C. These temperatures could be a natural limiting factor, in the absence of thermal refugia, which cutthroat

trout and other fish populations would need to tolerate in order to establish viable populations. If cutthroat trout are demonstrated to persist in the Chelan River during these natural temperature extremes (>23°C daily mean, up to 25°C daily maximum), but are demonstrated to be unable to persist at higher temperatures, then the daytime peak temperature could be controlled to prevent lethal conditions through release of additional flow during the daytime.

Increasing flows above 1,500 cfs does not significantly decrease the water temperature because the mass of water at 1,500 cfs absorbs the available heat. For example, a flow of 2,000 cfs does not produce a measurably lower water temperature than a flow of 1,500 cfs. The daily maximum temperatures predicted by the temperature model were only 0.07°C lower at 2,000 cfs than at 1,500 cfs (Appendix A, Table 7). Below 1,500 cfs, however, varying the flow does affect water temperature. At night, lower flows result in cooler water temperatures because a smaller body of water cools more quickly than a larger body of water. During a warm day, the reverse is true. Higher flows result in cooler water temperatures because a larger body of water warms more slowly than a smaller body of water. Therefore, increasing flows from 80 cfs to something below 1,500 cfs would significantly lower the water temperature on hot summer days.

However, increasing flows up to 1,500 cfs on hot summer days has two detrimental effects. First, it could hurt the fish because it would likely destroy areas of cool water refugia and reduces usable habitat. In some cases, these refugia may provide cooler water than is achieved by increasing flows up to 1,500 cfs. Second, increasing flows up to 1,500 significantly reduces the electrical output of the Project, particularly on hot summer days when power use peaks.

If determined necessary to protect a viable cutthroat population, Chelan PUD is prepared to release additional flow during daytime hours to prevent fish mortality from heat stress. The daytime flow releases will have a maximum flow of 1,500 cfs or natural inflow, whichever is less. The total annual volume of additional flow releases will be limited to 5,000 cfs-days. The effect of changes in flow on thermal refugia will be explored during the monitoring and evaluation actions that will be part of this biological evaluation and implementation plan. If necessary, additional flow releases will be reduced to preserve thermal refugia when a conflict between these measures exists. This approach limits the impairment of the existing beneficial use of these waters for maintenance of lake levels and power generation and, if necessary, significantly enhances beneficial use of the Chelan River for fish.

3.3.8 Other Options Considered to Improve Temperature Conditions

Additional actions to reduce thermal input may be pursued in Reaches 1, 2 and 4 under the CRBEIP. These actions could include promotion of the establishment of riparian vegetation in Reach 4 and adjustment of flows during the warmest periods of the summer. Temperature monitoring at several locations, snorkel surveys to monitor use and condition of fish species using the Chelan River, and aquatic macroinvertebrate sampling to evaluate ecosystem function would also be utilized.

The results of these surveys, particularly whether cutthroat trout will remain in the Chelan River during the summer months or migrate downstream, will determine if additional actions are necessary to prevent temperature conditions that exceed 25.3°C. In Reach 4, the presence of rearing steelhead or chinook juveniles will be determined and pumped water from the tailrace

could be used, when needed, to prevent lethal water temperatures during very hot summer afternoons. In Reach 4, opportunities may exist to increase shade in locations protected from high flow scouring by pulling together appropriate sized toe rock, woody debris and soils to create vegetated zones of stabilized banks for shade and food supply for aquatic organisms. The model can be used to evaluate the potential improvement in water temperatures that could be gained with riparian enhancement through bank projects and gravity irrigation from the Chelan River.

The NSWG also examined the feasibility of more flow and structurally intensive means to reduce water temperatures in the Chelan River. These included the feasibility of developing a deep water intake to provide colder water for the minimum flows and the potential of increasing groundwater inflow within Reach 1 for temperature moderation and thermal refugia.

Providing Project Inflow During Summer Months – Feasibility Analysis

The WDOE recommended investigating passing inflow to Lake Chelan into the Chelan River as an option for addressing the situation when Chelan River water temperatures exceed the 0.3°C standard during warm, summer months. The flow required to achieve the 0.3°C standard is estimated to range between 1,500 and 2,000 cfs, based on temperature modeling data. This magnitude of flow would eliminate generation at the Project from approximately mid-June through September during years with normal runoff volume and climatic conditions. The time period generation would be eliminated would vary between years: longer in years with higher than normal temperatures and/or lower runoff volume; shorter in years with lower than normal temperatures and/or higher runoff volume. Estimated costs (foregone revenue due to loss of generation) associated with providing a range of inflows is shown in Table 7-7.

Table 7-7: Estimated Costs of Providing Project Inflow

Flow Level	Annual Production MWh/Yr.	Reduction in MWh/Yr.	Annual Cost[1] (loss)
0 cfs (base)	365,366	0	0
500 cfs	353,334	12,032	$601,600
1,000 cfs	335,965	29,401	$1,470,050
1,500 cfs	315,133	50,233	$2,511,650
2,000 cfs	294,710	70,656	$3,532,800

[1] Value of energy = $50/MWh

Daily temperatures in the Chelan River at flows ranging between 1,500 cfs and 2,000 cfs would remain relatively constant and within 0.3°C of water temperatures measured at the spillway. This would meet the current temperature criteria for Class A waters. However, even if this temperature criterion were achieved, biological objectives could have a high probability of not being met. Useable habitat area at 1,500 cfs would decrease from 13 acres to about 9 acres (Table 7-2). Water entering the Chelan River would continue to follow the natural temperature warming cycle of Lake Chelan, which results in water temperatures that consistently exceed 22°C during late July and August, and can reach 24°C during the warmest period of the summer. Maintenance of Chelan River temperatures within 0.3°C would not prevent temperatures from approaching or exceeding the UUILT for cutthroat trout (Figure 7-2). Additionally, water temperatures would exist in the Chelan River exceeding the Zero Net Growth (ZNG) level for

cutthroat trout for most of the summer period. While actual cutthroat trout reaction to these conditions is unknown at this time, and will be investigated through the M&E program (section 5.4), the vast body of literature on this species indicates that predicted conditions would be adverse to developing and maintaining a viable population of cutthroat trout in the Chelan River (R2 and IA 2000; Sternberg 1987; Wydoski and Whitney 1979; Scott and Crossman 1974; Milstein 2000; WDFW 1992; NOAA Fisheries1996).

This option has been removed from consideration by the NSWG due to: 1) the predicted inability to achieve biological objectives; 2) loss of useable habitat area; and 3) extremely high cost. The NSWG determined that other options discussed previously in section 3 have the ability to achieve biological objectives in a much more cost efficient manner.

Pipeline to Lake Chelan Thermocline - Feasibility Analysis

A feasibility study was conducted early in the Lake Chelan relicensing process to investigate withdrawing cooler water from below the thermocline in the lake to reduce temperatures in the Chelan River. Based on the 1999 Water Quality Monitoring report (Anchor Environmental 2000), the location closest to the Project where water in the Wapato Basin of Lake Chelan stratifies during summer months is approximately five miles up the lake from the Project's intake. Downlake from this point, the water quality monitoring showed no thermocline, thus there would be less of a temperature benefit. A pipeline of at least this length would be required to provide cooler water from the lake to the Chelan River. In order to lay a pipe, capable of 24 cfs at 2 feet per second velocity, the required pipe diameter would be 48 inches. Assuming that a perforated pipe would meet fish entrainment standards, the head end of the pipe would be capped and water would enter the pipe through a series of holes, 2 inches in diameter, spread over the first 80 lineal feet of pipe. The pipe could be floated into place, than sank and anchored to the bottom. The pipe could be constructed of either ball-joint ductile iron or high density polyethylene (HDPE) plastic. The estimated cost for materials and installation, not including any mitigation for aquatic habitat for the pipe and installation process, is $2,500,000 per mile. Thus, a 5 mile long pipe would cost an estimated $12,500,000 for 24 cfs of water at the thermocline temperature of 10°C - 12°C in summer. A pipe with a 90 inch diameter could provide 80 cfs, at an estimated cost of $5 million per mile, for a total of $25 million. The NSWG determined that this option was not feasible due to the limited ability to provide cooler water to the Chelan River and the excessively high cost.

Ground Water Pumping for Upper Reaches - Feasibility Analysis

Pumped groundwater to reduce temperature at minimum flows, or alternatively provide cool water refugia, is a potential option for temperature control. Assuming a minimum flow of 80 cfs, a ground water source of 5 cfs (at 12°C) would be sufficient to reduce the temperature of the total flow by 0.7°C when the water temperature reached 24°C. Well sites in the local area are not noted for producing this volume of water. The Beebe springs, which provides part of the water supply for the Chelan Hatchery is only about 20% of this flow and the natural groundwater seeps in Reach 3 are on the same order of volume. The wells that supply the Chelan Hatchery, which draw from a large aquifer in the "wettest" part of the groundwater path from Lake Chelan to the Columbia River, also individually produce less than 0.3 cfs. Thus, it would require a substantial well field to produce 5 cfs for temperature control. The hard, competent till that the dam is built upon is unlikely to produce enough leakage to support a 5 cfs well field.

3.4 Riparian Vegetation - Limited Opportunities

The majority of vegetation in the Chelan River corridor is not riparian, but rather dry land adapted shrub steppe community. Pre-Project historical photographs indicate the composition, extent and condition of riparian vegetation are substantially unchanged since the pre-Project period. The arid climate, high scouring forces during peak flows, and the assumed steep moisture gradient in the soil at the active channel/floodplain boundary likely exceed the physiological limits of long-term survival for most riparian plants and constrain the potential width of the riparian zone and density of riparian vegetation, independent of base-flow conditions (Stillwater Sciences 2001). Some near-shore riparian vegetation would be expected to be established in the Chelan River if minimum flows are sustained throughout the river. However, the extent of this vegetation may be somewhat limited, since historical photographs indicate riparian vegetation was relatively sparse along the river before the Project was constructed (R2 and IA 2000).

3.5 Macroinvertebrate Community - Limiting Factors

Studies indicated that natural conditions would be limiting to salmonid fish production in the Chelan River. These factors included unfavorable water temperatures in the summer; low nutrient levels in the water coming into the river from ultra-oligotrophic Lake Chelan and limited input of terrestrial organic matter; low abundance of invertebrates as a result of the low fertility and warm summer water temperatures; low availability of spawning gravel; and high potential for gravel scour during high flow spill events. Principal among these limiting factors was the summer water temperature regime which exceeds the salmonid preference limit of 18°C. The Chelan River receives water from Lake Chelan at temperatures that exceed the temperature of zero net growth (19°C) for trout and salmon from July through the early part of September (R2 and IA 2000).

The production of benthic macroinvertebrates in the Chelan River lower tailrace can be considered to be extremely low (R2 and IA 2000). The density of benthic macroinvertebrates at the shallow sites ranged from 0 to 27 individuals per sq-m, while the density of benthic macroinvertebrates at deep sites ranged from 27 to 231 individuals per sq-m. In comparison, benthic invertebrate densities in moderately productive rivers in the Northwest typically range from 3,000 to 5,000 individuals per sq-m, while densities in productive rivers (such as the Deschutes) can exceed 10,000 individuals per sq-m (personal communication, E. Connor, R2, to J. Homa, IA, April 25, 2000). These results suggest that the amount of benthic invertebrate food organisms potentially available to fish in the bypass reach is very low.

The productivity of aquatic insects is low in the Chelan River for several reasons. The production of aquatic insects in rivers is largely driven by two sources of energy: allochthonous and autochthonous inputs. Both sources of productivity can be considered to be low in the Chelan River. Allochthonous materials include coarse particulate organic matter (CPOM) such as leaves, and fine particulate organic matter (FPOM) which is derived from the breakdown of CPOM by aquatic invertebrates and mechanical processes. Inputs of CPOM are very limited in the Chelan River, as most of these materials are trapped by Lake Chelan from their source areas in the Lake Chelan drainage basin. The scarcity of riparian vegetation along the Chelan River channel is also a reason for the low inputs of CPOM into this river system. Most FPOM originating from the upper watershed also settles into Lake Chelan. The only major source of seston (i.e., organic matter available as a food source to aquatic invertebrates) are zooplankton released from the

Lake Chelan outlet. Zooplankton densities are sufficient to establish filter feeding insect communities, including black fly larvae (Simuliidae) and net-spinning caddisflies (Hydropychidae), in the river channel immediately downstream of the Lake Chelan outlet, provided that minimum flows are provided in the river channel over a sustained period. These organisms have some food value to fish, albeit limited compared to the rich diversity of stonefly, mayfly, and caddisfly species present in rivers having adequate inputs of FPOM and CPOM.

3.6 Summary of Management Options

The NSWG considered a number of alternatives and options to promote accomplishment of the biological objectives for the Chelan River. These deliberations are summarized in matrix format (Table 7-8) and discussed in this section.

Upon the effective date of the New License, and in accordance with the time periods described in Proposed License Article 7, Chelan PUD will implement management options necessary to initiate the flow regime established in section 2.6.5. These include the flow release structure and associated stream channel to connect to Reach 1 (estimated cost $350,000), Reach 4 pumping station (estimated cost $2,500,000), stream channel habitat enhancements in Reach 4, spawning and rearing habitat enhancement in the tailrace (estimated cost $500,000 for Reach 4 and tailrace habitat), redd protection monitoring and evaluation, and the monitoring and evaluation program, which includes temperature monitoring.

A number of management options may be implemented, pending biological outcomes and success criteria evaluated in the monitoring and evaluation program. These include pumping of tailrace water into Reach 4 for rearing salmonids, powerhouse flow security for redd protection, tailrace under-gravel flow pipes, Reach 4 stream channel habitat structure changes, and temperature reduction actions for Reaches 1-3 (site-potential shade, refugia enhancement, flow increases during hot weather or daytime).

Management options that were evaluated, but found infeasible or inordinately costly for low or uncertain biological benefit, have been eliminated from consideration at this time. These options, and the reason they were eliminated at this time, include:

- Increase flow to keep Chelan River water temperatures within 0.3°C of natural temperatures when water temperature exceeds 18°C: This option was eliminated at this time because it is not expected to contribute significantly to meeting the biological objectives, it diminishes the useable habitat area in the Chelan River, and it has a significant negative impact to other existing beneficial uses (hydroelectric generation, early refill of Lake Chelan for recreation). The reduction in powerhouse discharge that would be required to provide the additional flow to the Chelan River could result in a degradation of habitat in the tailrace and below the confluence of Reach 4 with the tailrace. The cooler water that comes from the powerhouse would be replaced with water at a higher temperature coming from the Chelan River. Chelan River flows of 1,500 cfs or natural flows, when less than 1,500 cfs, would be required to keep water temperatures within 0.3°C of natural temperatures. Model predictions (Appendix A), for flows of 1,500 cfs during the summers of 2000, 2001 and 2002, determined that the daily maximum temperatures at bottom of Reach 3 would exceed 25°C on five days, 24-25°C

on fourteen days and 23-24°C on 58 days (total 77 days). Natural inflow to the Chelan River averages less than 1,500 cfs by the middle of the month, thus natural conditions could be still warmer that this prediction during low flow years. The temperature of water from the powerhouse only exceeded 23°C on 12 days during the same time period.

- Pipeline for minimum flow release structure to withdraw cool water from Lake Chelan thermocline: This option was eliminated at this time because the lower end of the Wapato Basin of Lake Chelan does not have a thermocline, water withdrawal from the nearest point with cooler temperatures would be two to five miles into Lake Chelan from the lake outlet, the environmental consequences of a very large pipeline on the lake bottom would likely be significant, the cost of the structure was excessive and the biological benefit uncertain.

- Ground water pumping into Reach 1: This option was eliminated at this time based on the low likelihood of being able to extract sufficient amounts of groundwater to influence temperatures or create thermal refugia with high volume wells. Other options for temperature control (site-potential shade, hot weather or daytime flow increases) had higher likelihood of success.

- Pumping into Reach 4 from the Columbia River: This option was eliminated at this time because the temperature benefits for summer fish rearing would be negated by less favorable temperatures in the Columbia River during the spawning period of chinook salmon. Also, the issues of ecological effects of mixing water supply sources, and the location of a pumping facility on the Columbia River raised significant doubt about the feasibility of this option.

Table 7-8: Matrix of management considerations and options considered for accomplishment of the biological objectives for the Chelan River

Description	Pros	Cons	Cost	Natural Sciences Working Group (NSWG) or Agency/Tribal Caucus (ATC) Discussion	NSWG or ATC Decision
Habitat and Flow					
Chelan PUD minimum flow proposal: 30 cfs December 1-May 15; 40 cfs May 15-November 30; Reach 4 design channel.	Provides habitat in Reaches 1,2, provides Reach 4 spawning and rearing habitat, compatible with lake level/recreation issues	Relatively low flow, questionable design channel use by chinook, unnatural diversion structure	Moderately High	The Agency/Tribal Caucus (ATC) did not particularly like this option due to the diversion structure component, questionable use of design channel, low flows, limited habitat availability	Chelan PUD initial proposal. Used to negotiate Preferred Alternative.
Agency/Tribal Caucus (ATC) minimum flow proposal: 350 cfs January 1-March 15; 450 cfs March 16-31; 650 cfs April 1-June 30; 350 cfs July1-October 15; 650 cfs October 16-November 30; 450 cfs December 1-31	Maximum habitat in Reach 4	Reduces habitat available in Reaches 1,2 from lower flows, impacts lake elevation/recreation, extremely expensive,	Extremely High	The Agency/Tribal Caucus (ATC) developed proposal based on studies (Bypass Reach Flow Releases, *IFIM*) to provide maximum habitat, flow, and minimal human intervention	Agency/Tribal Caucus (ATC) initial proposal. Used to negotiate Preferred Alternative.
Natural Sciences Working Group Proposal: see section 2.5.5, Table 4; minimum flow, pumped flow in Reach 4, habitat enhancement in Reach 4 and tailrace, ramping rates	Preferred Alternative. Achieves biological objectives while limiting adverse impacts on power generation and lake level management for recreation		High	The Natural Sciences Working Group negotiated this Preferred Alternative, over many months, as the best balance of natural and social resources	Preferred Alternative
Option A (Chelan PUD; Stillwater 40% draft, A1): Construct Reach 4 low flow temporary diversion, engineered side channel, provide pumping from tailrace to mid-engineered channel, use Reach 4 as high flow channel	Provides Reach 4 spawning and rearing habitat	Unnatural diversion structure, artificial berm to protect engineered channel, questionable use of small channel by chinook salmon	Moderate	The Agency/Tribal Caucus (ATC) did not particularly like this option due to the diversion structure component	Carried forward to the 80% design stage by the Agency/Tribal Caucus (ATC) for additional analysis
Option B (40% draft, A2): Construct Reach 4 high flow bypass channel, engineered Reach 4 channels, and provide pumping from tailrace to mid-Reach 4	Provides Reach 4 spawning and rearing habitat	Structure would need to be excessively large to accommodate flows	High		Removed from consideration by the Agency/Tribal Caucus (ATC) due to high flow bypass channel feasibility, minimal habitat benefit, and high cost
Option C (40% draft, A3): Provide reach 1 and 2 channel armoring and Reach 4 engineered channels	Reduces erosion in upstream reaches and deposition in Reach 4	Reduces aquatic habitat, potential riparian habitat, Reach 4 gravel supplementation required, high risk	High		Removed from consideration by the Agency/Tribal Caucus (ATC) due to adverse impacts, minimal habitat benefit, and high cost
Option D (40% draft, B): Increase tailrace spawning habitat	Provides additional tailrace spawning habitat		Moderate	The Agency/Tribal Caucus (ATC) was highly favorable of this option due to benefits for anadromous fish and high likelihood of success	Carried forward to 80% design stage by the Agency/Tribal Caucus (ATC) for additional analysis
Option E (40% draft, C): Highway bridge modification	Provides route for high flows to enter Columbia River, prevents scour in Reach 4	Significant re-construction of highway and railroad grades, minimal habitat benefit	Extremely High		Removed from consideration by the Agency/Tribal Caucus (ATC) due to minimal habitat benefit and high cost
Option F (40% draft, D): Construct a re-regulating dam in Reach 3 and engineered channels in Reach 4	Controls high Chelan River flows, provides some spawning and rearing habitat in Reach 4	Significant environmental impacts: block gravel recruitment, inundate reaches 1, 2, and 3, etc.	Extremely High		Removed from consideration by the Agency/Tribal Caucus (ATC) due to significant adverse environmental impacts, minimal habitat benefit, and high cost
Option G (40% draft, E): Construct Reach 4 high flow bypass channel and engineered Reach 4 channel	Provides protection for, and additional, Reach 4 spawning habitat	Structure would need to be very large to accommodate high flows	High		Removed from consideration by the Agency/Tribal Caucus (ATC) due to minimal habitat benefit, and high cost
Option H (80% draft, 1): Increase tailrace spawning habitat and use existing Reach 4	Provides additional tailrace and some Reach 4 spawning and rearing habitat	Provides little useable Reach 4 spawning and rearing habitat	Moderate	The Agency/Tribal Caucus (ATC) was favorable of this option due to benefits for anadromous fish and high likelihood of success in the tailrace	Carried forward to final design stage by the Agency/Tribal Caucus (ATC) for additional analysis (tailrace habitat)
Option I (80% draft, 2): Widen tailrace spawning habitat and use existing Reach 4	Provides greater tailrace and some Reach 4 spawning and rearing habitat	Moving berm eliminates riparian vegetation, provides little useable Reach 4 spawning/rearing habitat	Moderate	The Agency/Tribal Caucus (ATC) was concerned with moving the berm between the tailrace and Reach 4 due to destruction of best available riparian vegetation in the Project area	Removed from consideration by the Agency/Tribal Caucus (ATC) due to impact to riparian vegetation
Option J (80% draft, 3): Widen tailrace spawning habitat, add tailrace chinook rearing habitat, and use existing Reach 4	Provides greater amount of additional spawning habitat, provides rearing habitat	Moving berm would eliminate 1° riparian vegetation	Moderate	The Agency/Tribal Caucus (ATC) was concerned with moving the berm between the tailrace and Reach 4 due to destruction of best available riparian vegetation in the Project area	Removed from consideration by the Agency/Tribal Caucus (ATC) due to impact to riparian vegetation
Option K (80% draft, 4): Increase tailrace spawning habitat, create simple design channel, provide pumping to mid-design channel, and use Reach 4 for high flow channel	Provides greater tailrace and Reach 4 spawning and rearing habitat	Unnatural diversion structure, unnatural design channel, questionable use of design channel	Moderate	The Agency/Tribal Caucus (ATC) viewed favorably certain components (pumping, tailrace habitat modifications, Reach 4 design channel)	Favorable components (pumping, tailrace hab. mods, Reach 4 design channel) carried forward by the Agency/Tribal

Table 7-8: Matrix of management considerations and options considered for accomplishment of the biological objectives for the Chelan River

Description	Pros	Cons	Cost	Natural Sciences Working Group (NSWG) or Agency/Tribal Caucus (ATC) Discussion	NSWG or ATC Decision
		by chinook			Caucus (ATC) to final design for additional analysis
Option L (80% draft, 5): Increase tailrace spawning habitat, create sinuous design channel, provide pumping to mid-design channel, and use Reach 4 for high flow channel	Provides greater tailrace and additional Reach 4 spawning and rearing habitat	Unnatural diversion structure, unnatural design channel, questionable use of design channel by chinook, ability to maintain sinuous channel	Moderate	The Agency/Tribal Caucus (ATC) viewed favorably certain components (pumping, tailrace habitat modifications, Reach 4 design channel)	Favorable components (pumping, tailrace habitat modifications, Reach 4 sinuous design channel) carried forward by the Agency/Tribal Caucus (ATC) to final design stage for additional analysis
Option M (Final): Increase tailrace spawning habitat, construct tailrace juvenile (braid bar) rearing habitat, construct design channel in Reach 4, and provide pumping to head of design channel, construct new outlet structure to provide minimum flow at all lake elevations	Preferred Alternative: maximizes spawning and rearing habitat in tailrace and Reach 4 and provides highest security/opportunity for success	Some uncertainty regarding ability to protect Reach 4 habitat modifications from high flows, questionable chinook salmon use, pumping reliability	~$3M	The Agency/Tribal Caucus (ATC) developed this Preferred Alternative through the relicensing process. A monitoring and Evaluation Program was developed also to determine the success of the proposed actions over the early years of the New License term.	Preferred Alternative. Proposed for incorporation into Agreement by the Agency/Tribal Caucus (ATC)
Water Temperature					
Option A: Selective withdrawal system	Provides some cooler water to Chelan River	Questionable ability to affect Chelan River water temperature, significant environmental impacts: pipe installation 5 miles up-lake, very large pipe required, impacts to lake biota, permitting difficulties,	Extremely High	Cost estimates: 24 cfs (48" pipe) ~ $12.5M; 80 cfs (90" pipe) ~ $25M. Deemed not feasible by Natural Sciences Working Group (NSWG)	This option was eliminated by the NSWG due to significant adverse impacts, minimal benefit and high cost.
Option B: Groundwater pumping	Provides some cooler water to Chelan River	Questionable ability to affect Chelan River water temperature, provide significant volume of water, acquire water right permit	High	Ability to find and provide significant volume of groundwater is questionable, not ecologically prudent, provides limited benefit, would require time consuming water right acquisition, and be very expensive	This option was eliminated by the NSWG due to questionable effect, feasibility, and cost.
Option C: Reduce channel width/depth ratio in Reach 1	Reduce heating in Chelan River	Limited ability to affect significant water temperature change	Moderate	Thought by relicensing participants to have some ability to reduce Chelan River water warming in Reach 1. However, effect may be limited by ability to maintain in-stream structures during high flows, lack of shading, high water temperatures leaving the lake	Being considered by relicensing participants as potential option to increase ability to meet biological objectives
Option D: Additional seasonal flow releases	Increase ability to meet WQ standard of 0.3 C° in Chelan River	Decrease available fish habitat, erode Reach 4 habitat enhancements, may not meet biological objectives for Chelan R.	Potentially High, depending on flow	Thought by relicensing participants to have some ability to increase ability to meet WQ temperature standard	Being considered by relicensing participants as potential option to increase ability to meet biological objectives
Riparian vegetation					
Option A: Chelan River natural colonization	Baseline/natural conditions may be best/only possible outcome	Chelan River riparian vegetation similar today as early Project photos	Low	Majority of vegetation in the Chelan River is not riparian, but a xeric-adapted shrub-steppe community (Stillwater Sciences 2001). Local climatic conditions limit ability to enhance riparian vegetation	
Macroinvertebrate Community					
Option A: Chelan River natural colonization	Baseline/natural conditions may be best/only possible outcome, minimum flow provides habitat,	Tailrace populations extremely low, primarily lake organisms, limited by water T° and low N/P	Low	Limiting factors for production include: extremely low nutrient loading (N and P), low autochthonous production, warm water temperatures, low allochthonous production due to lack of riparian vegetation	Monitoring and Evaluation program developed by the NSWG will determine production in early years of New License term

SECTION 4: ACHIEVEMENT OF BIOLOGICAL OBJECTIVES

4.1 Functional Aquatic Ecosystem

The overall achievement criterion for establishment of a functional aquatic ecosystem is to demonstrate that the community of organisms inhabiting the river is healthy and diverse, given natural limiting factors and the feasibility of implementing measures. As discussed above, there are a number of natural limiting factors that determine the site-potential for the bypassed reach biotic community. This implementation plan for the Chelan River addresses a number of these natural limiting factors, in addition to the Project's effects. The biological objectives, used to evaluate the effectiveness of this implementation plan, are structured to allow for the natural limiting factors. In brief, Table 7-9 and Table 7-10 list the criteria for achievement of the biological objectives with the monitoring and evaluation components that will be used to determine achievement or need for alternative actions to the event they are feasible.

Table 7-9: Criteria for Achievement of Biological Objectives in the Chelan River

Fish species and use	Biological Objective	Measured Parameters	Evaluation Timeframe	Actions if Biological Objective Achieved	Actions if Biological Objective Not Achieved
Chinook Adult use of habitat Reach 4/Tailrace	Adult Production from fish produced in Chelan River	Ratio of Chelan River origin/other origin adult carcasses in spawning population	Years 1 - 10.	Maintain actions. No additional actions needed.	Continue until all feasible and reasonable habitat measures to achieve the objectives identified in 7-10 are implemented. When no further feasible actions exist and objectives not attained or the goal not achieved, the CRFF will recommend whether or not Chelan PUD should continue measures implemented.
Steelhead Outmigrant success	Adult Production from fish produced in Chelan River – net benefit to the ESU	Best professional judgment of CRFF and/or new technology showing adult origin	Years 5 - 10	Maintain actions. No additional actions needed.	Continue until all feasible and reasonable habitat measures to achieve the objectives identified in 7-10 are implemented. When no further feasible actions exist and objectives not attained or the goal not achieved, the CRFF will recommend whether or not Chelan PUD should continue measures implemented.
Cutthroat Create habitat to support a viable population of cutthroat trout in Reaches 1-3	200 resident fish	Number of fish via snorkeling surveys as specified in Table 7-10	Years 5 - 10.	Maintain actions. No additional actions needed.	Continue until all feasible and reasonable habitat measures to achieve the objectives identified in 7-10 are implemented. When no further feasible and reasonable actions exist and objectives not attained or the goal not achieved, the CRFF will recommend whether or not Chelan PUD should continue measures implemented.

Table 7-10: Other Criteria for Achievement of Biological Objectives in the Chelan River

Fish Species and Use	Biological Objectives	Measured Parameters	Evaluation Timeframe	Actions if Objective Achieved	Actions if Objective Not Achieved
Chinook Spawning Habitat Reach 4 and Tailrace	Areas developed to support spawning meet design habitat characteristics (depth, velocity, and substrate) at the design flow (as-built functionality).	Field measurement to confirm achievement of physical parameters.	Years 1 - 10, as needed to set flows or further modify channel.	Must be met.	Must be met.
Chinook Spawning Habitat Use Reach 4 and Tailrace	Distribution of spawning use should reflect distribution of constructed spawning habitat.	Spawning use, numbers, distribution and habitat characteristics of selected redds. Qualitative judgment	Years 1 – 10, as needed to set flows.	Maintain actions. No additional actions needed.	Determine if Project effect. Continue until all feasible and reasonable habitat measures to achieve this objective are implemented. When no further feasible and reasonable actions exist, CRFF will recommend whether or not Chelan PUD should continue measures implemented.
Chinook Spawning Habitat Quality Reach 4/ Tailrace Conditions suitable for survival from egg to emergence.	Intragravel Dissolved Oxygen ≥ 6.0 mg/l.	During all scheduled (non-emergency) powerhouse shutdowns, tailrace intragravel DO monitored hourly. During egg incubation, tailrace and Reach 4 intragravel DO monitored each week hourly for at least one 24-hour period.	Years 1-5. Extend if additional measures needed or as recommended by CRFF.	Must be met unless determined not a Project effect.	Must be met unless determined not a Project effect.
Chinook Spawning Success Reach 4/ Tailrace. Conditions suitable for survival from egg to emergence.	Egg to emergence success equal to ≥ 80 % of Methow River average or 70% survival, whichever is less.	At least 10% of redds capped and studied for egg to emergence success or other method recommended by CRFF.	Years 1 - 5.	Maintain actions. No additional actions needed.	Determine if Project effect. Continue until all feasible and reasonable habitat measures to achieve this objective are implemented. When no further feasible and reasonable actions exist, CRFF will recommend whether or not Chelan PUD should continue measures implemented.

Table 7-10: Other Criteria for Achievement of Biological Objectives in the Chelan River

Fish Species and Use	Biological Objectives	Measured Parameters	Evaluation Timeframe	Actions if Objective Achieved	Actions if Objective Not Achieved
Chinook Juvenile Rearing Habitat Use Reach 4/Tailrace	Presence and use of available habitat.	Snorkel surveys from emergence until fish move into Columbia River (emergence -June). Qualitative judgment.	Years 1-5. Extend for next 5 years if fry use is low.	Maintain actions. No additional actions needed.	Determine if Project effect. Continue until all feasible and reasonable habitat measures to achieve this objective are implemented. When no further feasible and reasonable actions exist, CRFF will recommend whether or not Chelan PUD should continue measures implemented.
Steelhead Spawning Habitat Reach 4 and Tailrace	Areas developed to support spawning meet design habitat characteristics (depth, velocity, and substrate) at the design flow (as-built functionality).	Field measurement to confirm achievement of physical parameters.	Years 1 - 10.	Must be met.	Must be met.
Steelhead Spawning Habitat Use Reach 4 and Tailrace	Distribution of spawning use reflects distribution of constructed spawning habitat.	Spawning use, numbers, distribution and habitat characteristics of selected redds Qualitative judgment. Spawning Surveys years 1 - 2 biweekly, weekly years 3 -10, March - May or as needed to set flows	Years 1 - 10. Extend if additional measures needed.	Maintain actions. No additional actions needed.	Determine if Project effect. Continue until all feasible and reasonable habitat measures are implemented. If can't reach use objective, maintain habitat achieved.
Steelhead Spawning Habitat Quality Reach 4/ Tailrace Conditions suitable for survival from egg to emergence.	Intragravel Dissolved Oxygen ≥ 6.0 mg/l	During all scheduled (non-emergency) powerhouse shutdowns, tailrace intragravel DO monitored hourly. During egg incubation, tailrace and Reach 4 intragravel DO monitored each	Years 1-5. Extend if additional measures needed or as recommended by CRFF.	Must be met, unless determined not a Project effect.	Must be met, unless determined not a Project effect.

Table 7-10: Other Criteria for Achievement of Biological Objectives in the Chelan River

Fish Species and Use	Biological Objectives	Measured Parameters	Evaluation Timeframe	Actions if Objective Achieved	Actions if Objective Not Achieved
		week hourly for at least one 24-hour period.			
Steelhead Spawning Success Reach 4/ Tailrace. Conditions suitable for survival from egg to emergence.	Egg to emergence success equal to ≥ 80 % of Methow River or 70%, whichever is larger	At least 10% of redds capped and studied for egg to emergence success or other method recommended by CRFF.	Years 1-5	Maintain actions. No additional actions needed.	Determine if Project effect. Continue until all feasible and reasonable habitat measures are implemented. If can't reach use objective, maintain best habitat achieved.
Steelhead Juvenile Rearing Habitat Use Reach 4/Tailrace	Fry presence and use of available habitat.	Snorkel surveys from emergence until fish move into Columbia River. 8 times per year, only when redds observed in area Qualitative judgment	Years 3 - 10	Maintain actions. No additional actions needed.	If steelhead rearing extensive and extended, evaluate habitat enhancement opportunities. Determine if Project effect. Continue until all feasible and reasonable habitat measures are implemented. When no further feasible actions exist and objectives not attained or the goal not achieved, the CRFF will recommend whether or not Chelan PUD should continue measures implemented.
Cutthroat Habitat Reaches 1-3	Presence of 200 fish including various age classes. Habitat improvements for cutthroat, as related to water temperatures, may include: - New, naturally evolved stream channel - Riparian shade - Thermal refugia/pumping studies - Increased flows	Snorkeling surveys, number, distribution, age of resident fish. Cross-sectional and average stream temperature measurements. Flow measurements.	Years 1-5 will serve as establishment of baseline. If 200 fish not achieved in year 5, then either continue studies for: A - 10 years beyond year 5 of New License to allow natural cutthroat colonization from Lake Chelan; or B - 5 years beyond year 5 of New License if no natural colonization is evident and test sample of cutthroat is deemed necessary by CRFF.	Maintain actions.	Determine if Project effect. Continue until all feasible and reasonable habitat measures are implemented. When no further feasible actions exist and objectives not attained or the goal not achieved, the CRFF will recommend whether or not Chelan PUD should continue measures implemented.

Table 7-10: Other Criteria for Achievement of Biological Objectives in the Chelan River

Fish Species and Use	Biological Objectives	Measured Parameters	Evaluation Timeframe	Actions if Objective Achieved	Actions if Objective Not Achieved
Water Temperature and Flow Monitoring	The achievement of specific water temperatures is not a criterion for achievement, rather providing a water temperature regime that facilitates biological achievement as defined above.	Water temperature will be monitored hourly at the forebay, in Reaches 1, 2, 3 and 4, and at the tailrace from March 15 to Nov 30. Flow will be measured hourly to determine flows through the penstock, into Reach 1 of the Chelan River, and into Reach 4 of the Chelan River. Additional temperature monitoring to determine emergence dates will be conducted as needed to accomplish monitoring objectives for chinook and steelhead spawning redd success.	Years 1 through 10 for this biological evaluation.	Not applicable Minimum flows must be met	Not applicable Minimum flows must be met

4.1.1 Macroinvertebrate Community

The limiting factors for development of the benthic, macroinvertebrate community are predominately natural conditions not related to the Project. The temperature regime is warm, which limits the species diversity, and the nutrients in the water are low because Lake Chelan is an ultraoligotrophic lake. The naturally poor conditions for establishment of riparian vegetation further limit food supply.

The potential of the Chelan River to develop an abundant and diverse population of aquatic macroinvertebrates was discussed in section 3, section 4 and the limiting factors analysis of the Bypassed Reach (Gorge) Flow Releases Study Report (R2 and IA, 2000). Observations in several eastern Washington streams indicate the optimum water temperature for prominent stream macroinvertebrates (i.e., mayflies, stoneflies and caddis flies) to be 10° C (50°F), with substantial decline in abundance and species diversity on either side of the apex (i.e., 4.4°C (40°F), and 15.6°C (60°F) (Tony Eldred, letter of 8/25/00 referencing statement of Rob Plotnikoff, Department of WDOE stream ecologist). The pool and riffle areas in the tailrace are representative areas with temperature and nutrient levels that represent the conditions that will exist in the Chelan River. Samples taken from this area had a low abundance and diversity of aquatic invertebrates. The majority of invertebrates collected were zooplankton produced in Lake Chelan that passed downstream through the penstock. The site potential for the macroinvertebrate community will likely be a low species diversity and density.

Methods for determining the health of a stream by sampling the benthic community have been defined by Washington State Department of Ecology in Benthic Macroinvertebrate Biological Monitoring Protocols for Rivers and Streams - 2001 Revision (Plotnikoff and Wiseman, 2001). They recommend using a reference site as the basis for comparison to determine if a stream's benthic community is healthy. Reference site information is used as a measure of biological potential for particular stream settings. Identifying a response in the biological community to environmental degradation is determined by comparison to a reference site. Appropriate reference sites for the Chelan River evaluation are the tailrace and the Chelan River upstream from the spillway. Establishment of a benthic community with comparable or greater density and species diversity than the references areas is the criterion for achievement. Over time, with establishment of site potential riparian vegetation, the food supply for benthic organisms is expected to increase, thus leading to improvement in the abundance and diversity of aquatic macroinvertebrates. However, the low fertility of the water from Lake Chelan will always be a limiting factor to establishing higher densities of aquatic invertebrates.

4.1.2 Fish Community - Reaches 1-3

The objective is to establish populations of native fish species, with emphasis on cutthroat trout.

Native Cool Water Species

The instream flows and stream channel conditions that will form with continuous flow are expected to be favorable to native cool water species, such as suckers, chubs, sculpins, mountain whitefish and other species that are resident in Lake Chelan. These species are expected to colonize the Chelan River over time. Some species are expected to appear immediately, based on their presence in the annual fish rescue operations that follow the end of spill under the current

license. These species include northern pikeminnow and rainbow trout. Other species that don't frequent the area near the spillway will populate the Chelan River more slowly. There are no plans to transplant native cool water species into the Chelan River, except if needed to reach conclusions in the monitoring and evaluation program.

The success criteria for achievement are to document that native species successfully colonize the Chelan River and establish populations that remain in the river throughout the year. Snorkel surveys will be conducted in years 1, 3, 5, and 9, with surveys at different seasons (April, August and November). In years 5 and 9, surveys will be conducted monthly. The CRFF may modify the years and timing of these surveys, as needed based on results from the M&E surveys. These surveys are highly effective in determining the presence of different species, including life stage. Habitat preferences will also be generally noted. The M&E surveys will detect any evidence of mortality or morbidity due to heat stress, which will provide the information needed to evaluate the need for additional temperature control activities. Habitat preference information may also be used in future management decisions regarding stream channel and shoreline actions.

Cutthroat

The provision of minimum flows and other actions taken to manage water temperature are expected to provide suitable habitat for adult cutthroat trout. Snorkel surveys will determine if cutthroat trout colonize the habitat and their behavior during the summer, when water temperatures will generally be above their preference zone. The very low population density of cutthroat trout in Lake Chelan is likely to make colonization very slow for this species, unless the stocking of catchable-sized cutthroat seeds the Chelan River from downstream movement of these fish. Based on the behavior of stocked rainbow trout, downlake movement of the stocked fish could result in fish entering the Chelan River during spill or through the minimum flow release structure.

The criteria for achievement of biological objectives (Tables 7-9 and 7-10) are documentation that development of a viable cutthroat trout population is not limited by Project operations, including implementation of the CRBEIP. A viable cutthroat population in Reaches 1-3 is defined as naturally produced (not stocked) fish, viable (population has representatives of several age classes), healthy (fish condition better than starvation), and of reasonable density (200 fish of various ages) consistent with the habitat conditions. If a viable population has not been achieved after the 10-year monitoring and evaluation program, then establishment of cutthroat trout population will no longer be a biological objective of the CRBEIP. Implementation of temperature control measures will not be required for populations that are artifacts of stocking programs. If a viable cutthroat trout population is not established, then long-term temperature control measures may not be required in Reaches 1-3.

The natural temperature regime of the Chelan River is not conducive to propagation of cutthroat trout. Thus, should a viable cutthroat trout population develop, but not maintain growth and health, or decline in density during the summer, separation of Project effects from the consequences of natural limiting factors could be difficult. High flow years will provide opportunities to observe the behavior and success of the cutthroat population when spill continues through July and into August. In these years, water temperatures will be the same as

they would be without the Project's influence. If the cutthroat trout population fails to maintain density during these spill conditions, then natural conditions will be the cause of failure.

4.1.3 Fish Community - Reach 4 and Tailrace

One objective of the NSWG is to promote suitable habitat conditions for successful spawning and rearing of chinook salmon and steelhead trout in Reach 4 and the tailrace of the Project. Criteria for achievement of biological objectives are contained in Tables 7-9 and 7-10. Rearing habitat will be created in Reach 4 and the tailrace, but it is unknown if the fish will use this habitat for extended periods or rapidly move into the more extensive rearing habitat in the Columbia River. Snorkel surveys will document the presence and habitat preferences of rearing chinook and steelhead fry. The criterion for achievement is documentation that habitat areas are created that fall within the predicted preference zone for velocity, substrate and cover. Presence of rearing chinook and steelhead fry will also be a demonstration of achievement, but absence of fish will not be termed a failure without evidence that a Project effect prevented fish from using the habitat.

Salmon and steelhead Spawning Habitat

Salmon and steelhead spawning habitat will be created in Reach 4 and in the tailrace, as described previously. The objective of the minimum flows and Reach 4 pumped flows are to create suitable depth, cover, velocity and substrate conditions for these fish. Objectives for the habitat that will be created by filling part of the tailrace with spawning substrate are the same. These physical parameters can be measured independently of fish use, although fish use is the best evidence of achievement. The criteria for achievement are to document that habitat was created and maintained, in accordance with the preference curves established in the IFIM study. Alternatively, if adult fish runs are strong and colonization occurs during the evaluation period, then the presence and success of spawning fish will also be considered in the determination of achievement. Achievement will be evident if spawning fish are distributed in suitable areas in the tailrace, Reach 4 and below the confluence of Reach 4 and the tailrace. Lack of use by spawning fish will not be termed a failure without evidence that a Project effect prevented fish from using the habitat.

Redd Protection

In addition to providing the habitat conditions that will attract and support spawning by chinook salmon and steelhead trout, the achievement of adequate survival of the eggs and alevins through incubation to emergence must be demonstrated. The survival rate of eggs and alevins in salmon redds is extremely variable under natural conditions, even in the best spawning habitat. The causes of poor survival range from conditions in the habitat to poor fertilization, disease, genetic disorders and pre-spawning temperature or other stress experienced by the fish during migration. A potential Project effect that has been identified is related to curtailment of powerhouse flows during the incubation period. A reduction or the cessation of powerhouse flows, which occurs in many years at some point during the refill cycle for Lake Chelan, could have an adverse impact on survival of eggs or alevins in the habitat created in the tailrace. Interruption of flows to Reach 4, from pump failure or other causes could also affect the success of redds in that section. The objective of the M&E program is to assure that redds are protected during the incubation and emergence periods.

Prevent Dewatering

The M&E program includes spawning surveys that will identify redds, with follow-up monitoring for those redds deposited in areas that could be dewatered by changes in Project flows. The criteria for achievement is to prevent dewatering of redds, to the extent feasible within control of the Project. Redds deposited below the confluence of Reach 4 and the tailrace are subject to flow and river stage fluctuations in the Columbia River, in addition to changes in flows from the Project. Alternative actions to correct dewatering, should it be detected, include deepening of spawning gravels when it can be accomplished without reducing the habitat characteristics that lead to selection by spawning fish. Flow from the pumping station will be maintained at the levels necessary to prevent dewatering of redds in Reach 4 (See Tables 7-9 and 7-10).

Prevent Low Oxygen, Have Adequate Metabolite Flushing

Powerhouse shutdowns are an unavoidable necessity in many years during the refill period for Lake Chelan. The change in flow and hydraulic gradient across the redds spawned in the tailrace could have an adverse effect on survival of eggs and alevins if intra-gravel flow is insufficient to maintain oxygen levels and flush out waste products. The gravel that will be placed in the tailrace to create the habitat will be free of fine sediments and highly permeable, which minimizes the hydraulic gradient necessary to maintain intra-gravel flow. Also, the continual water level fluctuations that occur in the Columbia River transmit up to the powerhouse as well. This constant rise and fall in Columbia River water levels results in consequent movement of flow into and out of the tailrace when the powerhouse is not operating. This water movement, coupled with the very permeable substrate, may be capable of maintaining intra-gravel flow. The M&E program will monitor dissolved oxygen levels in a representative sample of redds in and below the tailrace. This measurement will determine if redds in the tailrace fare any worse than redds below the confluence, where the minimum flows from Reach 4 will maintain a hydraulic gradient. The objective is to achieve egg-emergence survival of 70 percent, or levels of survival equivalent to 80 percent of the egg-emergence survival of summer chinook redds in the Methow River, whichever is less.

Criteria for achievement (Table 7-10) are the demonstration of successful spawning and survival of eggs and alevins at rates comparable to redds spawned in reference areas that are not affected by the Project. These reference areas are spawning sites below the confluence of Reach 4 and the tailrace, where spawning has occurred for over two decades, and in the Methow River (chinook). Monitoring of dissolved oxygen will detect if serious oxygen depletion is occurring in the redds in the tailrace, which provides for proactive triggering of decisions to protect the redds before survival is seriously affected. The objective is to maintain oxygen levels in the redds at or above 6.0 mg/l. Additional monitoring to determine survival, the result of all potential causative factors, including those beyond the Project's influence, will be done to establish a complete basis for evaluating achievement. This additional monitoring includes ratios of dead/live eggs and dead/live alevins and snorkel surveys for fry presence during the emergence period.

Several alternatives for redd protection will be evaluated and potentially implemented based on decision points during the M&E period. Detection of low dissolved oxygen in redds in the tailrace could trigger a decision to implement periodic operation of the powerhouse, as opposed to complete shutdown, during refill of Lake Chelan. Poor success of live/dead ratios in comparison to the reference area could trigger other options, including flow release pipes buried

into the gravel in the tailrace. An iterative approach is developed in the M&E portion of the implementation plan

4.1.4 Other Ecological Considerations

The main water quality parameter that is affected by the Project is water temperature in the Chelan River. The natural temperatures are much higher than the preference zone for cold-water species (R2 and IA 2000; Sternberg 1987; Wydoski and Whitney 1979; Scott and Crossman 1974; Milstein 2000; WDFW 1992; NOAA Fisheries 1996). The Project affects temperature in both a positive and a negative manner, depending on the location and time of year. Water issuing from the powerhouse is cooler than natural conditions in the summer, which could be a positive effect in the tailrace and lower Chelan River. However, minimum flows in the Chelan River will allow a greater range of daily temperature fluctuations than would the flows in the Chelan River without the Project. This can be a negative effect in June, July and early August, when the climatic conditions cause the water temperature to rise, but the minimum flows can have a positive effect for cold water fish when the Chelan River cools more rapidly than it would with natural flows. The potential for creation of cool water refugia at the lower minimum flows is also a possible positive effect. The M&E program is designed to evaluate the biological effects of the minimum flows from all perspectives, seeking a balance between the biological requirements and other beneficial uses of the Lake Chelan watershed. Temperature monitoring will be conducted annually at the forebay, in Reaches 1, 2, 3 and 4, and in the tailrace (Table 7-10). This monitoring will be used to guide decisions, in conjunction with the biological monitoring, to achieve the biological objectives of the CRBEIP. The achievement of specific water temperatures or numerical criteria is not a determinant of achievement because the natural conditions fail to meet those same criteria. The purpose of the temperature criteria is the protection of beneficial uses. Therefore, the criterion for achievement is to manage water temperature so that Project effects do not prevent the attainment of the biological objectives.

Water quality and biological objectives can also be adversely affected by oil and hazardous chemical spills. The Project has relatively few sources for spills, compared to other hydroelectric projects in the area, but oil, solvents and other hazardous materials are used in the powerhouse, at the spillway and in the transformer yard. The Chelan Powerhouse uses Francis turbines, which have no underwater oil reservoirs for hydraulic functions. The fact that the powerhouse and transformer yard are away from the Chelan River channel also reduces the potential for contaminant spills that could affect water quality. A Spill Prevention Control and Countermeasure Plan (SPCC) will be developed, as required in WDOE's 401 certification. Achievement is defined as employing best management practices as defined in the 401 certification. In the course of the New License, when equipment is refurbished or replaced, the potential of design improvements to reduce the likelihood of contaminant spills, improve spill detection and containment and reducing the number of contaminants used in normal operations will be given high priority.

SECTION 5: IMPLEMENTATION PLAN

5.1 Construct Flow Release Structure

The design and construction of the flow release structure will begin after Chelan PUD accepts a New License, which is expected to be in 2003. Design may be initiated following completion of the Agreement between the Parties, but construction cannot begin until the New License is accepted by Chelan PUD. Design of the flow release structure discussed in section 3.3.3 will be coordinated through the Chelan River Fishery Forum (CRFF).

5.2 Construct Reach 4 Pump Station and Channel Modifications

The primary intent of the CRBEIP is to guide development of final designs from the conceptual designs currently contained in section 3 (Management Considerations and Options Investigated) for proposed Reach 4 and tailrace habitat modifications.

The Natural Sciences Working Group (NSWG) developed habitat modifications in the Project tailrace and Reach 4 of the Chelan River to provide additional spawning and rearing habitat for anadromous salmonids (Figures 7-9 and 7-10). These conceptual habitat modification designs need to be developed into final designs in order to proceed with implementation and construction of habitat modifications, and provide assurance to parties participating in Agreement negotiations that these measures will be implemented. The CRFF will be responsible for reviewing the development and finalization of the habitat modifications. The process for developing final habitat modification design is outlined in Table 7-11.

Table 7-11: Habitat Modifications Implementation Plan Development

STEP	SCHEDULE (months following effective date of license)	LEAD ENTITY	M & E (Conceptual)
Develop Request for Proposal (RFP) (develop qualifications, budget, schedule, milestones, deliverables, selection criteria, etc)	Two	Chelan PUD[1]	
Issue RFP to selected consultants	Three	Chelan PUD[1]	
Review RFP's, select consultant	Four	Chelan PUD[1]	
Execute contract	Five	Chelan PUD	
Apply for Required Permits	Five	Chelan PUD[2]	
Initial kick-off meeting with consultant	Five	Chelan PUD[1]	Begin Plan Development
30% Review	Seven	Chelan PUD[1]	Continue M&E Development
60% Review	Eight	Chelan PUD[1]	Continue M&E Development
90% Review	Nine	Chelan PUD[1]	Finalize M&E Development
Final Report	Ten	Chelan PUD[1]	Final M&E Plan

Table 7-11: Habitat Modifications Implementation Plan Development

STEP	SCHEDULE (months following effective date of license)	LEAD ENTITY	M & E (Conceptual)
Educational Opportunities	Ten	Chelan PUD[3]	Begin Plan Development
Implementation Reach 4 Tailrace	During construction window before 2 years from effective date of the New License		

[1] Chelan PUD will be the responsible lead entity, but will require input from the CRFF.
[2] Chelan PUD will be the responsible lead entity, but requests technical assistance from the CRFF.
[3] Chelan PUD will be the responsible lead entity, but will require input from the CRFF.

The objective for Reach 4 is creation of approximately 2 acres (the amount available for chinook spawning at 320 cfs per the Bypassed Reach Flow Releases Study Report, IA and R2, 2000) of useable spawning and rearing habitat based on studies that have been conducted (Preference Curve Development for Fall Chinook Salmon, 2001) on water depth, velocity, and substrate size and permeability, and results of the ongoing temperature studies. The objective for the tailrace is to increase/expand existing habitat by between 1 and 2 acres (Stillwater Sciences report, 2001) of useable spawning and rearing habitat, based on the same studies conducted previously used for Reach 4 habitat modifications. Chelan PUD will fund maintaining Reach 4 habitat modifications throughout the life of the New License unless determined otherwise by the CRFF. Best management practices will be incorporated into final design specifications to ensure minimal environmental impact during construction of the habitat modifications.

Sufficient time period for testing and evaluating the Reach 4 habitat modifications will be provided to determine if fish are using the available habitat. If, after a period of time determined by the CRFF, the improvements do not appear to be having the desired effect, then the CRFF may recommend the reallocation of appropriated funding to other enhancements they determine may be more effective.

5.3 Initiate Chelan River Comprehensive Management Plan Flow Releases

Flow releases can begin as soon as the flow release structure and Reach 4 pumping station and habitat modifications have been completed. Tailrace habitat modifications must either be completed prior to chinook spawning in 2003 or postponed until emergence of the 2003 chinook spawning has been completed (June 2004).

5.4 M&E Program

The M&E program will provide the basis for determination that criteria for achievement of biological objectives have been met. The M&E program will also provide the information needed to make decisions on changes to the initial in the event that the criteria for achievement are not accomplished. The timing of the M&E activities is displayed in a flow chart at the end of this section (Figure 7-13).

5.4.1 Benthic Community Analysis

The benthic community will be sampled, following the methods in Plotnikoff and Ehinger (1997) and Plotnikoff and Wiseman (2001), in years 3, 5, 7 and 9. D-style kick net samplers will be used, with other methods as appropriate. Samples will be taken once per year between August 15

and September 15. Analysis will compare index sections in Reaches 1, 2 and 4 to index samples from above and below the bypassed reach of the Chelan River. Decisions that could be triggered by this M&E component relate to temperature management and possible introduction of organic material to provide food.

5.4.2 Fish Community - Reaches 1-3

Fish Population - Fall-Spring

Fish populations in Reaches 1-3 will be assessed by snorkel surveys. April and November surveys will be conducted to assess the presence and habitat use by fish during these periods with no temperature stress. Surveys will be in April and November in years 3, 5, 7 and 9. Surveys in years 7 and 9 will be monthly (12 per year). No decision triggers are expected to result from spring and fall surveys. These surveys are primarily for documentation of colonization.

Fish Population - Summer

Fish populations in Reaches 1-3 will be assessed by snorkel surveys. These surveys will be in August in years 3 and 5. Monthly surveys will be conducted in years 7 and 9. However, should significant cutthroat presence be detected in April in years 1 or 3, additional surveys through the summer may be initiated to observe response to increasing water temperatures.

Cutthroat Presence/Condition

Surveys in summer will monitor presence and condition of cutthroat trout as seasonal increases in temperature progress. Decision points that could be triggered by these surveys are the options for stream channel modifications (thalweg formation, site potential shade) and flow releases for temperature control.

Use of Thermal Refugia

Surveys in summer will monitor habitat use and determine if thermal pockets of cool water exist and are used by cutthroat trout. Decision points that will be addressed by these surveys are actions that could improve, protect or enhance thermal refugia. If no refugia exist or they aren't used, then other options for temperature control may be used. Increased flows for temperature control may conflict with protection and enhancement of thermal refugia, thus these surveys will help prioritize alternative actions between these options.

Potential M&E Outcomes Affecting Decisions

If cutthroat successful or leave before Project affects the temperature

Cutthroat may respond to temperature increases in the Chelan River that result from the natural temperature regime in Lake Chelan by migrating out of Reaches 1 and 2 before minimum flows have affected the daily temperature regime. Alternatively, the biological objective of cutthroat establishing a year-round population in the Chelan River may be achieved with no apparent impairment of their biological success during the temperature regime created by the minimum flows. In either case, these results would likely move temperature control actions to low priority, unless adverse effects in Reach 4 dictated otherwise. Management actions to address other resource needs would take higher priority.

If cutthroat stay but show harm at peak temperatures

Cutthroat may establish a viable population in Reaches 1-3, but show signs of impaired success during the summer period when minimum flows determine the temperature regime in the Chelan River. In this case, the monitoring and evaluation results would lead to implementation actions to moderate peak temperatures or increase thermal refugia. Management actions that could be implemented include daytime flow releases and stream channel modifications.

5.4.3 Fish Community - Reach 4

The fish community in Reach 4 is prioritized for chinook salmon and steelhead trout production. M&E is intended to document what has met expectations and define any deficiencies that are correctable. Primary focus is on successful spawning of chinook salmon, then steelhead trout.

Salmon/Steelhead Spawning

Spawning surveys will be done weekly from October 15 - November for chinook (years 2-9) and March - May for steelhead (years 3-9). Survival measurements of redds will be measured in the tailrace for chinook in years 2-7. Steelhead redd survival will be evaluated in Reach 4 and the tailrace in years 3, 5 and 7. Measurements of redd survival will be made in the reference areas (below Reach 4/tailwater confluence and Methow River for chinook) in the same years.

Redd Locations: Measurements of depth, velocity and substrate will be made in years 2-7 for chinook and 3-7 for steelhead. This data will be used to assess the amount of useable spawning habitat created for each species. Decision points based on this data include changes to the stream channel configuration to provide more habitat area within the preference zone. Flow decisions for the pumping station use during incubation and emergence will be based on this data.

Redd Survival: Measurements will include dissolved oxygen and redd capping, ratios of dead/live eggs and dead/live alevins or other methods determined by the CRFF. Decision points relying on these data will include powerhouse operation during chinook incubation in the tailrace, use of flow pipes within the gravel, and pump station use during incubation.

Salmon/Steelhead Rearing

Chinook and steelhead snorkel surveys will be done monthly from April - September, late November and early March for steelhead and during emergence for chinook, with some of these surveys done concurrently. Chinook surveys will be in years 3-7, while steelhead surveys in years 3-7. Decisions made based on these surveys could include changes to habitat characteristics in Reach 4 and the tailrace and use of the pumping station for temperature control during the summer.

Fry Presence/Absence

Fall – Spring: Presence of steelhead fry over the winter would indicate the potential need to provide habitat for age 1 and older steelhead juveniles. Absence of fry during winter would indicate migration to the Columbia River following emergence and post-emergent early rearing.

Summer: Presence of steelhead and/or chinook fry in the summer would trigger monitoring of temperature effects and fish condition. Use of the pumping station for temperature control is a likely decision based on observations of fry rearing in the summer. Modifications to the habitat in Reach 4 and the tailrace could also be triggered based on preferences observed by rearing fry.

Reach 4/Tailrace: Extensive presence of chinook fry in Reach 4 could lead to a decision to modify habitat types in Reach 4, which initially will be constructed to provide more habitat in the higher velocity range that steelhead prefer. Similarly, high concentrations of steelhead fry in the tailrace could lead to a decision to add boulder type habitat placements in the tailrace.

Habitat Use

Habitat preferences for depth, velocity, substrate and cover will be observed during snorkel surveys. Decisions regarding fine-tuning of habitat types in Reach 4 and the tailrace could result from these observations (add LWD, more or fewer pools, etc.).

5.4.4 Water Quality

Temperature and Flow

Water temperature and flows will be monitored hourly. Monitoring for temperature will be done in the forebay and tailrace, and Reaches 1, 3 and 4. Monitoring for flows will be from gauged discharge from the spillway and minimum flow release structure for the Chelan River and from the powerhouse discharge for the tailrace. Water temperature and flow monitoring are being done to provide information to help in decisions based on biological outcomes and for management of day-to-day operations. Monitoring data for flows and temperature will be available and posted on the Chelan PUD website on a monthly basis from July through September, and quarterly for the rest of the year. Measures that might be implemented based on temperature data are channel modifications in Reach 1 (thalweg formation, site potential shade), use of pumping station during summer in Reach 4, and daytime flow increases in Reach 1.

Other Parameters

Water quality sampling for other physical, chemical and biological parameters of Lake Chelan and the Chelan River currently meet the water quality standards for these water bodies. The Project is not known to affect these parameters (nutrients, pH, dissolved oxygen, total dissolved gas, coliform bacteria). However, to confirm that the Chelan River complies with water quality standards for parameters important to support aquatic life, two general assessments of water quality will be conducted in years 3 and 5, with results reported in years 4 and 6, following acceptance of the New License. The parameters and measurement locations are dissolved oxygen, turbidity, and pH, measured in Reach 4, and total dissolved gas, measured below the spillway. Lake Chelan is on the 303(d) list for pesticide residue in fish tissues, but this is not affected by the Project.

The Project has a Spill Prevention Control and Countermeasure Plan (SPCC) to establish precautionary measures to prevent spills of oil and hazardous substances (Appendix 1). The plan includes procedures to expeditiously control and remove any harmful quantity of oil or hazardous substances discharged. The Lake Chelan Project has not had spills in "harmful quantities" as defined in 40 CFR Part 110 – (a) Quantities "that violate applicable state water quality standards" or (b) "Cause a film or sheen upon or discoloration of the surface of the water or adjoining shoreline or cause a sludge or emulsion to be deposited beneath the surface of the water or adjoining shorelines" or (c) "a discharge of more than 1,000 U.S. Gallons of Oil in a single event." However, the SPCC has been developed to address the storage and management of petroleum products at the Project. The plan is designed to fulfill the requirements of 40 CFR 112,

U.S. Environmental Protection Agency (EPA) Oil Pollution Prevention Regulations. The plan describes practices, procedures, structures, and equipment at the facility to prevent spills and to mitigate or preclude any adverse impact on the environment.

5.4.5 Reports in years 4, 6, 8 and 10

Biological Objectives Status Reports will be issued that summarize the results of the M&E program, evaluating achievement in meeting the biological objectives, and review of management decisions taken to meet biological objects. These reports will (1) summarize the results of the monitoring and evaluation program, and evaluate the need for modification of the program, (2) describe the degree to which the biological objectives have been achieved, and the prospects for achieving those objectives in the next reporting period, (3) review measures implemented to meet those biological objectives, and (4) recommend any new or modified measures, including monitoring and evaluation needed to achieve the biological objectives, to the extent practicable. These reports will be issued in years 4, 6, 8 and 10 following the effective date of the New License; draft reports will be issued by February 28th; final reports by April 30th. These reports will be prepared by Chelan PUD in consultation with the CRFF and will make recommendations for modifications to the implementation plan and M&E plan, when needed, to meet biological objectives of the CRBEIP.

5.5 Assessment of Biological Objectives

5.5.1 Management Decisions

Flow Security Options For Tailrace - Decision Triggers

Decision triggers for flow security options are low dissolved oxygen (below 6.0 mg/l) related to powerhouse shutdowns, dewatering of redds, ratios of dead/live eggs and alevins that are worse than for redds in reference areas. M&E would be used to test the concepts for effectiveness in meeting physical indicators and biological improvements.

Temperature Management for Summer Rearing

Pumping into Reach 4 - Decision Triggers

Decision triggers for summer pumping into Reach 4 are: concurrent observations of high peak temperatures, exceeding natural peak temperatures, at minimum flows; presence of steelhead fry before peak temperatures; reduced density or condition of steelhead fry during or after peak temperatures, and a temperature differential between the tailrace and Reach 4. M&E would be used to evaluate benefits of pumped flow over minimum flow.

Habitat Use - Modify Habitat Types

Flow or Channel Changes - Decision Triggers

Decision triggers would be selective use by steelhead or chinook of habitat types that were less abundant than other habitat types that were more abundant. The feasibility of modifying the habitat type to achieve the biological objective will be evaluated with M&E on an incremental basis.

Additional Actions for Reaches 1-3

These measures will be implemented, based on demonstrated Project effects and biological necessity, to the extent feasible.

Site-potential Shade

Decision triggers would include high daytime temperatures that exceed natural peak temperatures, evidence of adverse reaction by the fish or benthic community to the temperature spikes, and model results (sensitivity analysis) that shows a significant decrease in the peak temperature after implementing actions.

Evaluation of Refugia

Decision triggers would include determination that cutthroat are heavy users of cool water pocket thermal refugia, indications that certain flows enhance or destroy the refugia, and biological indications of benefit. Most likely decision would be related to conflict between increasing daytime flow and maintenance of cool water refugia.

Evaluation of Daytime Flow Increases

Decision triggers would be M&E observations of adverse cutthroat trout reaction to daytime peak temperatures, model predictions on the efficacy of increased daytime flow, and M&E evaluation of the benefits to the cutthroat trout community in the Chelan River.

5.5.2 Biological Objectives Achieved

Based on the studies performed under this CRBEIP and the results presented in the reports prepared under section 5.4.5, WDOE, after conferring with the CRFF, no later than 10 years after the effective date of the Agreement, is expected to make a determination on whether the biological objectives in the CRBEIP and state water quality standards have been achieved. If it is determined that the biological objectives have been met but non-compliance with water quality standards exists, it is expected that WDOE will initiate a process, as necessary, to modify the applicable standards through rulemaking or some other alternative process authorized under federal and state law.

5.5.3 Biological Objectives Not Achieved

If WDOE determines that some or all of the biological objectives have not been met and that Chelan PUD has undertaken all known, reasonable, and feasible measures to achieve those objectives consistent with supporting, protecting, and maintaining the designated and existing beneficial uses, WDOE intends to initiate a process to modify the applicable water quality standards to the extent necessary to eliminate any non-compliance with such standards. Following the issuance of the final Biological Objectives Status Report in year 10, if Chelan PUD concludes that one or more biological objectives cannot be met in whole or in part despite its having undertaken all known, reasonable, and feasible measures to meet those objectives consistent with supporting, protecting, and maintaining the designated and existing beneficial uses, Chelan PUD may consult with the CRFF regarding whether to modify or eliminate a biological objective and/or associated implementation measure, consistent with Proposed License Article 7.

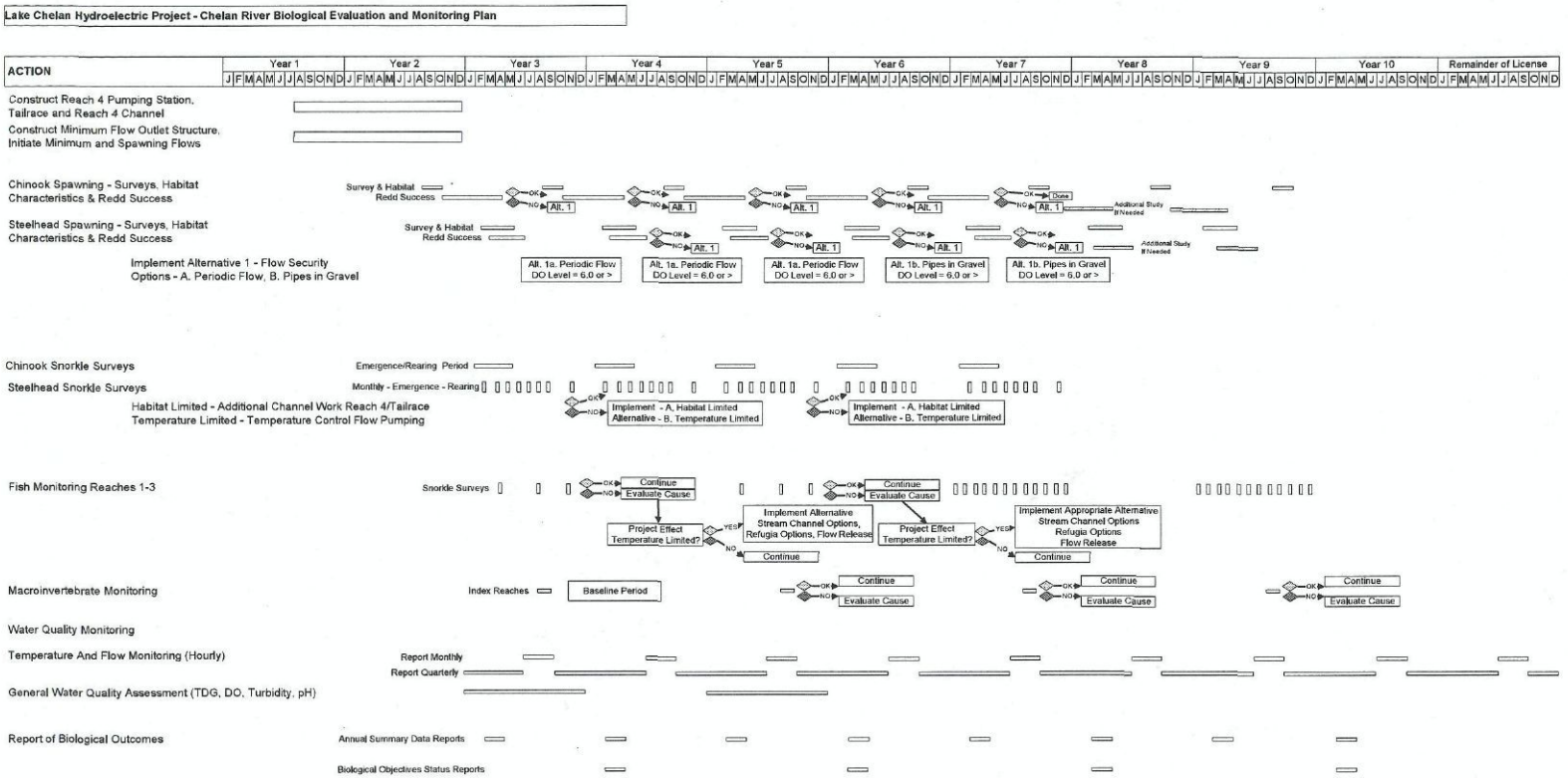

Figure 7-13: Chelan River Biological Evaluation and Monitoring Plan Flow Chart

SECTION 6: CONCLUSION

The CRBEIP and the other chapters in the Comprehensive Plan provide for the protection and enhancement of existing beneficial uses of the Lake Chelan Basin that are affected by the Project, while substantially restoring a significant number of environmental values associated with the Chelan River. The CRBEIP is designed to achieve certain biological objectives concerning restoration and/or enhancement of biological resources in four separate reaches of the river and to support, maintain and protect the designated and existing beneficial uses of the Chelan River Basin, pursuant to applicable federal and state law. The M&E program in the CRBEIP is designed to evaluate the biological effects of the minimum flows and other actions from all perspectives, seeking a balance between the biological requirements to support fish populations and the protection of other beneficial uses of the Lake Chelan watershed. The net effect of the CRBEIP is to provide significantly improved biological functions and values compared to existing conditions. This CRBEIP is supporting material for Chelan PUD's application (March 26, 2002) to WDOE for state certification of compliance with water quality standards and other appropriate requirements of state law (Section 401 certification) in regard to Chelan PUD's license application for the Project. This CRBEIP is also submitted as a "mitigation plan" pursuant to the Washington State "Aquatic Resources Mitigation Act".

The Chelan River receives water from Lake Chelan that is quite warm in the summer due to natural conditions. The water temperature is further affected as it passes through the Chelan River from natural causes, with the temperature response of the river closely related to the instream flow and physical characteristics of the channel and shoreline. The relationship of these physical factors to the flow regime is a principal focus of the measures contained in the CRBEIP. These measures balance the use of stream channel and riparian habitat improvements, flow releases from the dam and flow augmentation with pumping from the tailrace to provide protection for existing beneficial uses of the Lake Chelan Basin, while increasing the net ecological benefit for aquatic species in the Chelan River. The CRBEIP includes an implementation plan, providing for staged implementation of alternative actions based on the results of an extensive biological monitoring and evaluation program. The measures implemented pursuant to this Chapter, and the resulting river conditions, are expected to be the basis for modifying water quality standards, if necessary, for the Chelan River.

SECTION 7: LITERATURE CITED

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DETERMINATION OF NONSIGNIFICANCE

Description of Proposal: *Chelan River Reach 4 Pump Station New Water Right. Public Utility District No. 1 of Chelan County is requesting a new water right for 350 cfs from the Chelan River to meet obligations set forth in the new Lake Chelan Hydroelectric Project (Project) License. The water will be used to enhance instream flows and habitat in Reach 4 of the Chelan River and in the Project tailrace.*

Proponent: *Public Utility District No. 1 of Chelan County*

Location of proposal, including street address, if any: *The point of diversion will be located in the tailrace of the Lake Chelan Hydroelectric Project (Project), S30, T27, R23. Place of use will be in Reach 4 of the Chelan River and in the tailrace of the Project, Sections 29 and 30, T27, R23. The site is located near the town of Chelan Falls, Chelan County, WA, approximately 32 miles north of Wenatchee.*

Lead Agency: *Public Utility District No. 1 of Chelan County*

The Lead Agency for this proposal has determined that it does not have a probable significant adverse impact on the environment. An environmental impact statement (EIS) is not required under RCW 43.21C.030(2)(c). This decision was made after review of a completed environmental checklist and other information on file with the lead agency. This information is available to the public on request.

_ There is no comment period for this DNS.

X This DNS is issued under 197-11-350(3); the lead agency will not act on this proposal for 15 days from the date below.

Responsible Official: *Jennifer Burns*

Position / title: *Environmental Coordinator*

Address: *P.O. Box 1231 Wenatchee, Washington 98807 1231*

Date: *September 10, 2007*

Signature: Jennifer Burns

A. BACKGROUND

1. Name of proposed project, if applicable:

Chelan River Reach 4 Pump Station Water Right

2. Name of applicant:

Public Utility District No. 1 of Chelan County, Washington

3. Address and phone number of applicant and contact person:

Waikele Hampton (509) 663-8121, Ext. 4627
P.O. Box 1231
Wenatchee, Washington 98807-1231

4. Date checklist prepared:

September 5, 2007

5. Agency requesting checklist:

Public Utility District No. 1 of Chelan County, Washington

6. Proposed timing or schedule (including phasing, if applicable):

Chelan PUD anticipates putting the water to beneficial use beginnning in May of 2009, assuming receipt of the water right and completion of habitat construction and pump installation.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

Yes. As per requirements set forth in the new Lake Chelan Hydroelectric Project License Order, Offer of Settlement, Lake Chelan Comprehensive Plan, and Water Quality Certification, Chelan PUD will construct, no later than two years after the effective date of the license, modifications to improve habitat in Reach 4 and the tailrace. Chelan PUD will use standard river habitat restoration techniques to provide and maintain gravel areas fro spawning, create pools, increase channel sinuosity, and moderate velocities. The proposed water right that is the subject of this SEPA will provide additional water to this enhanced habitat.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

NEPA review and ESA consultation addressing the habitat construction, pump station construction, and other related work were approved October 10, 2003 and October 14, 2005, respectively.

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

Necessary permits have been received for the construction of the Reach 4 and Tailrace habitat.

10. List any government approvals or permits that will be needed for your proposal, if known.

Water Right from Department of Ecology
Permits necessary for the construction of the pump station have been received.

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)

License Article 408 of the FERC License (issued November 6, 2006) and the associated License Article 7 of the Settlement Agreement (signed by Ecology and Chelan PUD and issued on October 8, 2003) and 401 Water Quality Certification (Ecology Administrative Order No. 1233, dated June 1, 2004) for the Lake Chelan Hydroelectric Project mandates Chelan PUD implement specific measures to achieve the agreed upon objective of creating approximately two acres of useable spawning and rearing habitat for summer steelhead and Chinook salmon in Reach 4 of the Chelan River within two years of the effective date of the new License.

Additional flow will be provided in Reach 4 during the summer steelhead and Chinook spawning periods to provide greater depths and velocities that will improve spawning habitat conditions for these species. Flows proposed to meet the intent of the Reach 4 habitat enhancements total 320 cfs. The Settlement Parties propose to provide up to 240 cfs via five pumps (screened to meet the applicable state and federal fish screening criteria) in the tailrace. Water will be pumped only from the tailrace channel. This water will flow from the pumps to a canal which will convey the water approximately 1,000 foot upstream to an outlet structure. The outlet will also be screened to exclude fish. From the outlet structure the water will pass into the new enhanced habitat channel in Reach 4 of the Chelan River to provide reliable flows to a fish spawning and rearing area. From this part of the Chelan River, the water will flow to the confluence with the tailrace. The remaining 80 cfs would be provided by the release of storage water at the dam.

Depending on the location of redds that may be created by spawning salmon or steelhead in Reach 4, the pumps may also be used to prevent dewatering of redds during incubation. In addition, the flows from the pump station may be used, if needed, to manage temperatures in Reach 4 during the rearing period of juvenile salmon and steelhead. Water temperatures in the tailrace are no warmer than the water temperature at the dam, thus during hot periods in the summer the addition of water from the pumping station could be used to reduce temperatures during the day and evening. Temperature reduction could be used to prevent temperatures in Reach 4 from exceeding critical levels, such as the ultimate upper incipient lethal temperature.

No water will be stored. The system will be designed and constructed so that the conveyance canal will be drained when not in use. The water from the powerhouse will be diverted from the tailrace in the sense that it will enter the Chelan River at a point farther upstream than it does presently.

The subject of this SEPA is Chelan PUD's request for a water right for 350 cfs. This request is in excess of the 240 cfs that is currently planned to be diverted to Reach 4 to allow flexibility during the development of the water right. If during the development of the water right, it is determined that the upper reaches no longer require year-round flow, but Reach 4 still requires the 320 cfs, Chelan PUD would plan to provide the full 320 cfs via the pump station. To facilitate this potential change in the project, Chelan PUD is requesting the full 320 cfs (+30 cfs for contingency to account for head control and pump tolerance).

Chelan PUD is requesting a water right development schedule of 50 years to match the FERC license.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

The project is located near the Lake Chelan Hydroelectric Project powerhouse, located at 400 Powerhouse Road, Chelan Falls, Chelan County, WA.
The proposed diversion is located in the NE 1/4 of the SE 1/4 S30, T27, R23.
The place of use is located in Sections 29 and 30, T27, R23.

From Wenatchee, take Highway 2/97 east across the Odabashian Bridge. Follow 2/97 north approximately 34 miles. Just after crossing the Beebe Bridge, take a left on to SR 150 Hwy. After about .4 mile, take a left onto the Chelan Falls Rd. Follow this approximately .8 mile to the Powerhouse Access Rd. Take a right. The point of diversion and habitat enhancement area are approximately .5 mile beyond the turn.

B. ENVIRONMENTAL ELEMENTS

1. Earth

a. General description of the site (check one): ☒ Flat, ☐rolling,☐ hilly, ☐steep slopes, ☐mountainous, other _____.

b. What is the steepest slope on the site (approximate percent slope)?

c. What general types of soils are found on the site (for example, ☐clay, ☒sand, ☐gravel, ☐peat, ☐ muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.

Pogue very stony fine sand

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

No

e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.

None.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

N/A

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

None

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

N/A

2. Air

a. What types of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

None

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

No

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

N/A

3. Water

a. Surface:

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

Yes, the proposed diversion is from the Chelan River, a tributary of the Columbia River.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

The proposed source of water is the Chelan River.

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

None

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

Yes, the proposal itself is for a withdrawal of up to 350 cfs from the Chelan River below the Lake Chelan Hydroelectric Project Powerhouse.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

Yes

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

No

b. Ground:

1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities if known.

No

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals. . . ; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

None

c. Water runoff (including stormwater):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

None

2) Could waste materials enter ground or surface waters? If so, generally describe.

No

d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

N/A

4. Plants

a. Check types of vegetation found on the site:

- ☐ deciduous tree: alder, maple, aspen, other
- ☐ evergreen tree: fir, cedar, pine, other
- ☒ shrubs
- ☒ grass
- ☐ pasture
- ☐ crop or grain
- ☐ wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
- ☐ water plants: water lily, eelgrass, milfoil, other
- ☐ other types of vegetation

b. What kind and amount of vegetation will be removed or altered?

None

c. List threatened or endangered species known to be on or near the site.

No threatened or endangered species are known to occur on site. However, Ute ladies'-tresses occurs approximately 1/2 mile north of the project site.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

None

5. Animals

a. Check any birds and animals which have been observed on or near the site or are known to be on or near the site:

birds: ☐ hawk, ☒ heron, ☒ eagle, ☒ songbirds, other _____

mammals: ☐ deer, ☐ bear, ☐ elk, ☐ beaver, other _____

fish: ☒ bass, ☒ salmon, ☒ trout, ☐ herring, ☐ shellfish, other _____

b. List any threatened or endangered species known to be on or near the site.

The following species are known to be present in the Columbia River, downstream of the project site.
Upper Columbia River spring-run chinook (Onchorynchus tshawytscha)
Upper Columbia River steelhead (O. mykiss)
Bull trout (Salvelinus confluentus)

c. Is the site part of a migration route? If so, explain.

The tailrace contains populations of fish that enter from the Columbia River.Chelan PUD biologists have observed several native fish species congregating on the alluvial fan where the tailrace, the bypassed reach of the Chelan River and the Columbia River converge. Summer and fall chinook salmon spawn on gravel in this area in October and November. The gravel and flow conditions are also appropriate for native cyprinid fishes, such as chiselmouth chubb, peamouth chubb and northern pikeminnow. Suckers have been observed spawning in the spring.

d. Proposed measures to preserve or enhance wildlife, if any:

The proposed project is intended to create and enhance spawning, incubation, emergence, and rearing flows and spawning and rearing habitat.

6. Energy and natural resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Electrical will be used to run the pumps to divert water.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

None

7. Environmental health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

No

1) Describe special emergency services that might be required.

None

2) Proposed measures to reduce or control environmental health hazards, if any:

N/A

b. Noise

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

None

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

None

3) Proposed measures to reduce or control noise impacts, if any:

N/A

8. Land and shoreline use

a. What is the current use of the site and adjacent properties?

The site of the point of diversion is within the Lake Chelan Hydroelectric Project tailrace. Place of use is a river bed and banks.

b. Has the site been used for agriculture? If so, describe.

No

c. Describe any structures on the site.

The Lake Chelan Hydroelectric Project powerhouse is located just feet from the point of diversion.

d. Will any structures be demolished? If so, what?

No

e. What is the current zoning classification of the site?

Point of diversion and place of use are both classified as RR20.

f. What is the current comprehensive plan designation of the site?

Point of diversion and place of use are both designated as RR20.

g. If applicable, what is the current shoreline master program designation of the site?

Rural

h. Has any part of the site been classified as an "environmentally sensitive" area? If so, specify.

No

i. Approximately how many people would reside or work in the completed project?

None

j. Approximately how many people would the completed project displace?

None

k. Proposed measures to avoid or reduce displacement impacts, if any:

N/A

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

Adherence to local, state, and federal land use laws and regulations.

9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

None

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

None

c. Proposed measures to reduce or control housing impacts, if any:

N/A

10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

N/A

b. What views in the immediate vicinity would be altered or obstructed?

N/A

c. Proposed measures to reduce or control aesthetic impacts, if any:

N/A

11. Light and glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

None

b. Could light or glare from the finished project be a safety hazard or interfere with views?

No

c. What existing off-site sources of light or glare may affect your proposal?

None

d. Proposed measures to reduce or control light and glare impacts, if any:

N/A

12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?

Boating, camping, picnicing, white water rafting

b. Would the proposed project displace any existing recreational uses? If so, describe.

No

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

N/A

13. Historic and cultural preservation

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.

The Lake Chelan Hydroelectric Project, placed in service in 1927, is listed in the National Register under Criteria A and C. Contributing elements include the dam, surge tank, intake tubes, power tunnel, the penstock and the powerhouse. The plant is considered to be a good example of 1920s state-of-the-art hydroelectric technology.

b. Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site.

Cultural resource surveys conducted during the relicesning of the Lake Chelan Hydroelectric Project indicated no landmarks or evidence of historic, archaeological, scientific, or cultural importance occur in the project area.

c. Proposed measures to reduce or control impacts, if any:

N/A

14. Transportation

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.

The site is served by the Chelan River Road and the Powerhouse Access Road. No new access is proposed.

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

No. The nearest transit stop is approximately 4.5 miles to the northwest in Chelan.

c. How many parking spaces would the completed project have? How many would the project eliminate?

None

d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private).

No

e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

No

f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.

None

g. Proposed measures to reduce or control transportation impacts, if any:

N/A

15. Public services

a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.

No

b. Proposed measures to reduce or control direct impacts on public services, if any.

N/A

16. Utilities

a. Check utilities currently available at the site: ☒electricity,☐ natural gas, ☒water, ☐refuse service, ☐ telephone, ☐sanitary sewer, ☐septic system, other.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

Utilities needed for the operation of the pumps station has been addressed in other environmental reviews.

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: Wanda Hampton

Date Submitted: 10 Sept 07